RADIOLOGY

A MONTHLY JOURNAL DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

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RADIOLOGY

A MONTHLY PUBLICATION DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

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Diagnosis of Congenital Obstruction of the Stomach and Small Intestine in the Newborn[1]

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THE SURVIVAL OF newborn infants with alimentary obstruction depends as much on prompt and accurate preoperative diagnosis as on adequate nutritional measures and expert surgery. The earliest possible recognition of an obstructive condition is essential, particularly if obstruction is complete, since the rapidly progressing dehydration and the danger of bowel necrosis preclude delay in operative intervention beyond two days. Accurate preoperative information as to location, character, and severity of the obstruction enables the surgeon to choose the optimal time for operation and to predetermine the most favorable surgical approach. While prompt recognition and preliminary classification of an obstructive condition are responsibilities of the clinician, the task of providing detailed preoperative information is assigned to the roentgenologist.

The purposes of this paper are: (*a*) to familiarize the roentgenologist with the pertinent clinical signs and symptoms of congenital alimentary obstruction in order to guide him in his choice of the most effective method of examination; (*b*) to evaluate current roentgen-diagnostic technics and their indications and contraindications; (*c*) to discuss roentgen criteria in the diagnosis of obstructive lesions involving the infantile stomach and small intestines as reported in the literature; and (*d*) to report cases of congenital obstruction of the stomach and small intestines in which an accurate preoperative diagnosis was made by applying methods of adult gastro-intestinal roentgenology to the study of the infantile alimentary tract. Discussion of the technical and roentgen-diagnostic aspects of esophageal and rectal obstruction is omitted, since excellent articles on these topics are available in the recent literature (4, 6, 8, 11, 14, 19). For the embryological, statistical, and surgical aspects of congenital alimentary obstruction the reader is referred to such standard works as Ladd and Gross (14), Caffey (2), and Brennemann (1).

When consulted about a suspected case of alimentary obstruction, the surgeon will be interested chiefly in the following information:

1. Is the obstruction complete, thus requiring immediate intervention, or incomplete, permitting a delay of surgery and thus providing an opportunity to build up the nutritional state of the infant?
2. Is the obstruction intrinsic, calling for bowel anastomosis or resection, or extrinsic, usually not necessitating bowel repair?
3. At what level is the bowel obstructed and where is the point of obstruction, rep-

[1] Accepted for publication in February 1948.

TABLE I: IMPORTANT CLINICAL SIGNS OF TOTAL AND SUBTOTAL OBSTRUCTION

Level and nature of obstruction	Onset of obstructive signs	Type of vomiting	Contents of vomitus	Stools	Abdominal examination	Other clinical findings
ESOPHAGUS						
Atresia	After first feeding attempt, preceded by flow of saliva	Regurgitation with violent choking, through mouth and nose	Frothy formula and mucus. No bile	At first only meconium, later intestinal secretion	Sometimes epigastric fulness	Pulmonary complications. Associated congenital anomalies
STOMACH						
Hypertrophic Pyloric Stenosis	2–10 weeks after birth	At first regurgitation; later projectile	Ingested food. No bile	Scanty, containing bile. Progressive constipation	Palpable tumor after vomiting. Epigastric distention; visible peristalsis	Rapid dehydration. Depressed respiration. Male-female ratio 4:1
DUODENUM						
Atresia-Aplasia, Pre-Vaterian	1–2 days after birth. Not immediately after feedings	Persistently projectile	Ingested food and mucus. No bile. May become blood-tinged	Scanty meconium, containing mucus and bile	Epigastric distention; visible peristalsis after feeding	No vernix cells in stools (positive Farber's test)
Atresia-Aplasia Post-Vaterian	1–2 days after birth. Not immediately after feedings	Persistently projectile	Food and mucus, containing bile	Scanty meconium, acholic, pasty, containing mucus	Epigastric distention; visible peristalsis after feeding	No vernix cells in stools (positive Farber's test)
JEJUNUM AND ILEUM						
Atresia-Aplasia	1–2 days after birth. Several hours after feeding	Progressively projectile	Bile-stained food; may become fetid or bloody	Dry, scanty, acholic meconium	More or less generalized distention. Intestinal patterning	No vernix cells in stools (positive Farber's test)
Meconium Ileus in Pancreatic Insufficiency	Not distinguishable from atresia			Scanty, inspissated meconium	More or less generalized distention. Intestinal patterning	Pulmonary changes: atelectasis, pneumonic lesions, lung abscess, etc.
COLON AND RECTUM						
Imperforate Anus (including blind rectal pouch and diaphragm)	One to several days after birth	Irregular; no relation to feedings; progressively worse	Bile-stained food. May become fecal	Absent	Progressive distention. Tympanites. Intestinal patterning	Absence of anal opening, dimpling or shallow rectal pouch. Associated congenital anomalies

TABLE II: IMPORTANT CLINICAL SIGNS OF PARTIAL AND INTERMITTENT OBSTRUCTION

Level and nature of obstruction	Clinical signs
ESOPHAGUS	
Cardiospasm	Irregular regurgitation of food, responding favorably to catheterization and change in feeding regime. Absence of gastric secretion in vomitus
Diverticulum; Duplication	Regurgitation only if lumen of esophagus is considerably narrowed. Obstructive signs usually delayed until solid food is given
STOMACH	
Pyloric Spasm	Vomiting at irregular intervals, not always related to feedings, not as forceful as in stenosis. Absence of pyloric tumor; normal stools; little or no weight loss. Response to change in formula and antispasmodics plus sedatives
Diaphragmatic Hernia	Obstructive signs usually less prominent than signs of respiratory trouble
DUODENUM	
Volvulus and Peritoneal Bands	Vomiting usually persistent but may be intermittent. Vomitus may contain bile, and stools may contain milk curds and vernix cells (negative Farber's test)
Stenosis; Diaphragm; Annular Pancreas	In severe cases picture of atresia, but stools may contain milk curds and give negative Farber's test
Duplication	Obstructive signs may be delayed for weeks or months. A soft, fluctuant tumor may be palpable. Hemorrhage not uncommon
JEJUNUM AND ILEUM	
Duplication	Same as in duodenal duplication
Mesenteric and Omental Cyst	Seldom severely obstructing at or shortly after birth. A soft, fluctuant, movable, gradually enlarging tumor may be palpable
Meckel's Diverticulum with Band	Obstructive signs associated with intestinal bleeding. Male-female ratio, 4:1
Abdominal Tumor	Obstructive signs associated with a palpable firm mass lesion
Abdominal Hernia	Obstructive signs, possibly associated with a palpable soft mass lesion
COLON AND RECTUM	
Stenosis	Ribbon-like stools. Bulging of perineum when baby strains. Constipation
Imperforate Anus with Fistula	Constipation. Appearance of meconium in urethra, vagina or perineal fistula
Duplication	Constipation plus abdominal distention, depending upon amount of pressure from cyst

resenting information helpful in determining the site of incision?

4. Are pulmonary complications present, affecting the choice of anesthesia?

Whether one is dealing with a complete or incomplete obstruction can in many cases be determined on the basis of simple clinical observations concerning response to feeding, type of vomiting, contents of vomitus, bowel behavior, contents and color of stools, inspection and palpation of abdomen and perineum, etc. In general, complete obstruction at any level will manifest itself in a much more violent and persistent manner and will be noticeable much sooner after birth than incomplete obstruction. A most valuable and at the same time simple test for differentiation between incomplete and complete obstruction is based on Farber's (5) observations on the presence or absence of swallowed cornified epithelial cells (vernix cells) in the meconium. The absence of such cells (positive Farber's test) is presumptive evidence that an intestinal or colonic atresia exists.

A differentiation between intrinsic and extrinsic obstruction on a clinical basis is not always possible, although intrinsic is usually synonymous with complete and extrinsic with incomplete obstruction. Thus the clinical picture of an intrinsic stenosis will simulate that of extrinsic narrowing by a peritoneal band, or the clinical manifestations of duodenal atresia will be indistinguishable from those of a completely obstructing annular pancreas.

The approximate level of obstruction may be recognizable from the type and contents of the vomitus, while the point of obstruction usually remains a matter of speculation. The presence and extent of pulmonary complications are usually well appreciated on the basis of physical signs and symptoms.

In Tables I and II an attempt is made to tabulate the pertinent clinical findings in the presence of the more important obstructive lesions at various levels of the alimentary tract. For practical purposes, one table is devoted to total or subtotal, and the other to partial or intermittent

obstructions. The signs as tabulated are subject to certain obvious limitations: the frequent failure of various obstructive lesions to present distinct differences, the dependence of the clinician upon the alertness of the nursing staff for accurate observations and records, and the brief period of observation permissible before the institution of treatment. In view of these handicaps, the clinical differential-diagnosis as outlined is intended merely to serve as an aid in selecting the proper diagnostic procedure.

Once a clinical diagnosis of alimentary obstruction has been made, several ways are open to further investigation. As indicated by an ever increasing number of case reports in the pediatric, surgical and roentgenologic literature, the most widely employed diagnostic aid and the most accurate method of demonstrating obstructive lesions of any type and at any level is provided by the x-ray.

Obstructive lesions of the esophagus and rectum require special roentgen-diagnostic procedures, which will not be discussed here. When the clinical evidence points to an obstructive condition situated below the esophageal and above the rectal levels, the problems facing us are largely those of adult gastro-intestinal roentgenology and the same methods of examination are at our disposal, namely, radiography without the use of contrast media (flat-film technic), radiography with the use of contrast media, fluoroscopy, and fluorography (spot-film technic). These methods may be employed singly or in combination according to the particular situation at hand, aiming at greatest possible accuracy of information without jeopardizing the life of the infant or interfering with subsequent operative procedures.

The majority of writers emphasize that flat films taken in various positions usually provide sufficient information as to degree and level of obstruction, and that the knowledge gained from using contrast media is not always worth the risks involved. Interpretation of flat films, however, is equally subject to error as diagnosis based on clinical observations, unless "typical," unequivocal findings are manifest.

The value of flat films is wholly dependent on the presence or absence of swallowed air and its distribution. Pathological conditions manifest themselves by a conspicuous absence of air shadows over a certain area of variable extent, or by abnormal air distention of bowel loops associated with formation of fluid levels involving a segment of variable length. Such evidence may be clear-cut and sufficient to warrant immediate intervention. Frequently, however, little if any information can be gained from flat films that are taken during the first twenty-four hours of life, since not enough air may have been swallowed to fill the proximal segment. On the other hand, films taken after the abdominal distention has reached a marked degree may show such an enormous dilatation of the obstructed segment as to obliterate any underlying detail by overlapping, balloon-like air shadows and intersecting fluid levels, making it impossible to judge the level of the lesion. Furthermore, one should be aware of the fact that in the infant both large and small bowels may normally contain a considerable amount of gas (swallowed air), making a differentiation between milder grades of obstruction and the normal state difficult, particularly if radiographs are made in the recumbent position only.

In the diagnosis of infantile obstruction, the demonstration of fluid levels appears to be of greater significance than the mere presence of seemingly gas-distended loops. It is therefore advisable to obtain erect or inverted films in every case of suspected bowel obstruction, besides the conventional recumbent views which may yield valuable information as to the presence of gas-free areas delineating mass lesions and as to location of the point of obstruction.

If a definite conclusion cannot be reached on the basis of clinical observations plus flat films, the oral administration of barium may become desirable, in spite of the commonly recognized hazards involved by

this procedure (4, 13, 14), namely, regurgitation and aspiration of swallowed barium, with resultant pulmonary complications; clogging of the lumen of the distal segment by inspissated barium after surgical removal of the obstructing lesion, thus hampering the passage of bowel contents in intestinal loops that already contain tenacious material and are usually in a more or less collapsed state; and delay in surgical intervention. The barium mixture, be it a suspension in water, glucose or milk formula, should be thin, and the amount administered should be kept as small as possible. The use of a stomach tube in the form of a soft rubber catheter is valuable not only as a means of easily controlled administration of the barium mixture but also to remove secretion and retained food before the examination is started and to aspirate any barium remaining in the stomach after completion of the examination.

The danger of barium clogging the distal loops after surgery is most real in cases of atresia. Since a considerable amount of the barium will have accumulated in the terminal loop at the time of operation, it may be advisable to have the surgeon remove, by gentle massage, the contents of the distended loops after having opened the blind end. With this simple procedure a large amount of inspissated mucus, bile, and ingested food can usually also be removed.

It is this writer's impression that the potential dangers of administration of barium *per se* are of lesser consequence than the delay of surgical intervention entailed by barium studies. In a case of low ileal obstruction, for instance, many hours of repeated checking may be required for following the sluggish passage of the contrast meal down to the point of obstruction. It is in cases of this kind that the urgency of operative intervention may outweigh the desirability of accurate preoperative diagnosis. The decision whether or not to use barium should be made only after carefully evaluating all of the evidence obtainable from clinical data and plain films, a matter requiring close cooperation between clinician, surgeon, and roentgenologist.

As far as the procedure of contrast examination is concerned, proper selection and optimal combination of various roentgenologic technics are the chief prerequisites of clear demonstration and correct interpretation of pathologic conditions. Mere inspection of conventional films taken after ingestion of barium will often defy correct analysis, not only because of the topographical and physiological peculiarities encountered in the infantile intestinal tract, but also due to the fact that the contrast shadows are apt to produce an inscrutable tangle in which identifying landmarks, such as mucosal pattern, typical caliber, haustration, etc., are absent. Contrast studies undertaken solely for the purpose of demonstrating distention and fluid levels would seem superfluous since flat films are quite adequate for demonstration of these abnormalities. For the highest diagnostic accuracy within the shortest possible time, the diagnostic procedure should be based on fluoroscopy, a practice long established as routine in adult gastro-intestinal roentgenology.

As applied to the study of the adult gastro-intestinal tract, the objectives and details of special fluoroscopic technics no longer need appraising (the latest and probably most comprehensive discussion of this subject by an American author we owe to Templeton, 17). It seems to the present writer that painstaking fluoroscopy supported by spot-filming offers distinct advantages over conventional radiographic procedures in the infant as well. Besides the important function of acting as a guide to subsequent filming, fluoroscopy provides valuable information often not obtainable from roentgenograms, as well as information supporting radiographic evidence. Deviations from the normal anatomical position of certain segments, such as malrotation or displacement by mass lesions, are immediately apparent fluoroscopically but may be obscured by overlapping barium shadows at

the time films are taken. Significant factors in obstructive lesions such as rate of progress of the contrast meal or abnormal peristaltic phenomena provide more striking evidence while observed in action than on the frozen image of the film. Furthermore, the constancy or intermittent nature of pathologic situations is better appreciated from continuous viewing than from roentgenograms taken at arbitrary intervals. (The total fluoroscopic exposure time should of course be kept within safe limits.)

The accuracy of fluoroscopic examination is greatly enhanced by skillful palpation. Gentle pressure exerted by a single glove-protected finger will help to determine the mobility of a certain segment, to clear the field from interfering contrast shadows, to accelerate or retard the progress of the bowel contents, and to test the consistency and mobility of a mass lesion. To permanently record fluoroscopic observations, especially those of a fleeting or cyclic character, spot films taken at the optimal moment and with the patient in the most favorable position often furnish a far more satisfactory source of information than any number of roentgenograms made after the conventional fashion. For this procedure any spot-filming device may be used that allows a minimum exposure time of 1/20 sec. At a milliamperage of 60, the optimal range of voltage lies between 40 and 60 kv.p. Compression either by manual pressure, a compression cone, or some radiolucent material attached to the cassette holder, will help to increase photographic contrast, to push interfering contrast shadows out of the field, and also to immobilize the part examined. Distortion caused by the short target-film distance may be partly overcome by having the baby lie on a low footstool attached to the top of the examining table.

STOMACH

Hypertrophic pyloric stenosis, the most common congenital obstructive lesion of the gastro-intestinal tract, is probably the only obstructive condition between the esophagus and rectum in which the clinical history and findings are usually characteristic enough to warrant surgical intervention without roentgenologic study. Conditions to be considered in the differential diagnosis, such as pyloric spasm, food incompatibility, neurogenic and toxic vomiting, and duodenal obstruction, can usually be excluded on the basis of history and physical examination. It is the atypical cases, in which absence of a palpable tumor or development of obstructive signs shortly after birth make recognition difficult, that call for x-ray examination.

The roentgenologic signs of hypertrophic pyloric stenosis may be grouped as of supportive and of absolute value. As recently emphasized by Templeton (17) and Hefke (9), most of the "classical" signs, such as enlargement and deformity of the stomach, hyperperistalsis, and delayed emptying, are today considered obsolete, and only two signs of supportive value have survived: palpation of a pyloric tumor under the fluoroscope and a delay of more than five minutes in the opening of the pylorus. A routine flat film is valuable in ruling out juxtapyloric obstruction where abnormally large air deposits may be found distal to the stomach.

The only absolute roentgenologic sign, as first demonstrated by Meuwissen and Sloof in 1932 (quoted by Hefke, 9), is the typical deformity of the prepyloric region and pylorus produced by the pyloric hypertrophy. An excellent recapitulation of the characteristic changes is contained in Templeton's book (17), to which the reader is referred for detailed information. The pyloric canal is narrowed and elongated up to 3 cm. at the expense of the distal portion of the antrum, being transformed into a uniform, rigid channel that often shows a crescentic upward swing and usually lies concentric in relation to antrum and duodenal cap (Fig. 1). Both antral and duodenal extremities of the pyloric mass may produce shallow, shoulder-like impressions on the greater and lesser curvature sides of these segments. In

order to see these changes and to demonstrate them on spot films or conventional radiographs, painstaking fluoroscopy is required. This not only reveals the presence of the characteristic deformity but also permits optimal timing and positioning (right oblique prone or right lateral) for subsequent filming. Exposures, preferably spot films with the baby held in position by a compression device, should be made only when pylorus and proximal duodenum are definitely filled, frequently an event of a fleeting nature, whose recurrence should be watched for fluoroscopically, in order to establish persistency of the pathologic finding. If, on the initial examination, the pylorus cannot be satisfactorily visualized, it is advisable to re-examine one or two hours later, following atropinization. The spasm so frequently associated with organic pyloric stenosis will then be lessened and a more continuous passage established. As demonstrated in Case 2, spasm may at times produce a picture strikingly similar to organic stenosis, at least temporarily, and in such a case only repeated fluoroscopic observation and radiographic confirmation will provide the correct answer. If only once during the examination the filled prepyloric area and pylorus assume normal or nearly normal proportions, a diagnosis of hypertrophic pyloric stenosis becomes most unlikely.

As a condition of exceptional rarity and therefore of but minor differential-diagnostic significance, membranous prepyloric obstruction may be mentioned, a case of which was reported by Touroff and Sussman (18). Barium studies made in this case were difficult to interpret, since a persistent spasm of the antral sphincter muscle imitated a pyloric incisura, producing an hourglass appearance of the preantral and dilated antral portions of the stomach, resembling the picture of a high duodenal atresia. Membranous obstruction will obviously be impossible to distinguish from true atresia of the stomach, a condition of equally uncommon occurrence.

Fig. 1. Case 1. Hypertrophic Pyloric Stenosis. One of several spot films showing identical findings, taken in the right lateral position. St. Stomach. S. Shoulder-like indentations in antrum. P. Elongated, narrowed pyloric canal showing characteristic upward swing. D. B. Duodenal bulb.

CASE 1: HYPERTROPHIC PYLORIC STENOSIS: Two weeks after birth, G. R., a normally developed white boy, began to regurgitate his feedings; he became fretful and lost 8 ounces in weight within two weeks. His bowel movements were regular and of normal consistency. At the time of admission to this hospital (four weeks after birth), he appeared undernourished and dehydrated. His abdomen was protuberant but soft, with occasional visible peristaltic waves crossing the epigastrium. After feedings, the pyloric contractions could be felt as an oval mass.

Clinical Impression: Hypertrophic pyloric stenosis.

X-ray Examination (day of admission): After bottle feeding of a barium-formula mixture, the stomach appeared to be of about normal size and configuration. No barium passed into the duodenum for about an hour. Later fluoroscopic check-ups and spot films taken in the right lateral position revealed a persistent narrowing and elongation of the pyloric canal, which formed a thread-like structure 2 cm. long, with a definite upward swing (Fig. 1). There were shallow indentations in the distal contour of the antrum to either side of the pylorus. Occasionally a small amount of barium passed into the duodenum, outlining a well shaped duodenal bulb. There was about 60 per cent gastric retention at two hours, and no retention at twenty-four hours.

Roentgenologic Impression: Hypertrophic pyloric stenosis, probably with pyloric spasm.

Subsequent Course: After eleven days of antispasmodic and antidehydration therapy, operation and further hospitalization were refused by the parents, the baby having shown no significant gain in weight and having continued to vomit. On re-

admission, four days after discharge, the child was emaciated and markedly dehydrated. After five days of preoperative care, a Ramstedt operation was performed, the diagnosis of organic pyloric stenosis having been confirmed by the surgeon. Massive atelectasis and pneumonia in the right lung developed and death occurred on the sixth postoperative day.

Comment: Although the clinical picture left little doubt as to the organic nature of the obstruction, contrast studies were performed chiefly to convince the parents of the necessity of surgical intervention. Fluoroscopy and spot films revealed the most important roentgen findings in hypertrophic pyloric stenosis, namely persistent narrowing and elongation of the pyloric canal. If, as in this case, the pyloric opening time is greatly prolonged, repeated fluoroscopic check-ups aided by spot filming will provide a more satisfactory and economic way of arriving at a diagnosis than serial roentgenograms.

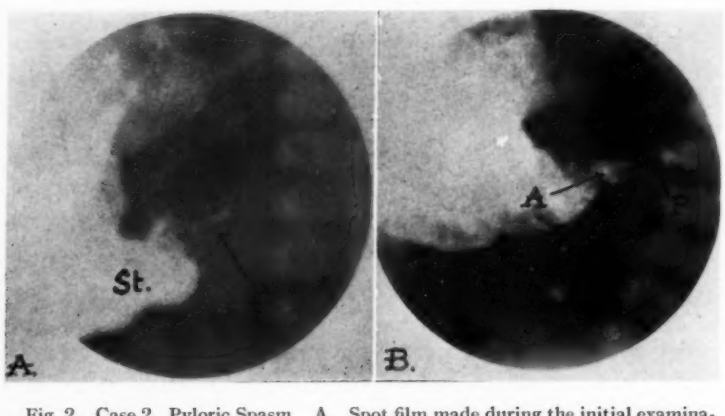


Fig. 2. Case 2. Pyloric Spasm. A. Spot film made during the initial examination, showing elongation and narrowing of the pyloric canal (*P*). B. Spot film made on repeat examination, following atropinization, showing cone-like narrowing of antrum (A) but no pyloric elongation.

CASE 2: PYLORIC SPASM: M. K., a white boy, was admitted to this hospital twelve days after birth, with a history of regurgitating some of his feedings. Vomiting had become gradually worse and projectile in character. Stools had been scarce but normal in color. On admission, physical examination showed a tense abdomen with no palpable masses or visible peristalsis. Mild dehydration was present.

X-ray Examination (day of admission): After administration of milk-barium mixture by bottle, the stomach was seen to be of normal size and position. The opening of the pylorus was delayed for about ten mirutes. Fluoroscopy and spot films (Fig. 2A) taken in the right lateral position, shortly after the stomach had begun to empty, showed a thin, elongated pylorus, but this finding could not be demonstrated again. Two hours later there was approximately 50 per cent gastric retention. At six hours the stomach was empty.

Roentgenologic Impression: The findings were suggestive of hypertrophic pyloric stenosis, but to rule out spasm definitely, re-examination after antispasmodic therapy was advised.

Clinical Course: In spite of glucose infusions, change in formula, and atropinization (Syntropan), the baby continued to vomit occasionally. The vomiting was projectile in character but did not occur with any regularity. Stools were normal. A slight but steady weight loss took place during the hospital stay.

Repeat X-ray Examination (seven days after admission): The pyloric opening time was within normal limits. There was an almost constant spasticity of the antrum, and the prepyloric portion together with the pylorus formed a cone-like structure (Fig. 2B) instead of the linear shadow noted on the previous examination. The gastric emptying time was not significantly delayed.

Roentgenologic Impression: Antral and pyloric spasticity. No conclusive evidence of organic stenosis.

Subsequent Course: The frequency of vomiting diminished somewhat during the following week and the baby was discharged on the twelfth day after admission. At home the vomiting gradually stopped within two weeks, and up to the present age (13 months) no further trouble has occurred. X-ray check-up has revealed a slightly delayed pyloric

opening but no abnormality in the configuration of antrum and pylorus.

Comment: Although obstructive signs developed shortly after birth and no pyloric tumor was palpable, the lack of response to antispasmodic therapy and the initial x-ray finding of delayed pyloric opening as well as pyloric elongation and narrowing made a diagnosis of hypertrophic pyloric stenosis very likely. Repeat contrast studies with special attention to the appearance and behavior of the pylorus after atropinization, however, revealed the spastic nature of the obstruction, a diagnosis borne out by the subsequent course. This case illustrates the importance of a changing pyloric pattern in the diagnosis of pyloric spasm, in contrast to the persistency of the pathologic findings in the presence of pyloric hypertrophy.

DUODENUM

In contrast to the relative simplicity of roentgenologic differentiation of infantile pyloric obstruction, the differential diagnosis of congenital obstruction of the duodenum offers a variety of possibilities. Conditions to be considered are aplasia and atresia, stenosis and diaphragm, annular pancreas, peritoneal band and volvulus, aberrant vessels and duplication. The clinical picture may indicate whether the obstruction is complete or incomplete, but it usually fails to shed any light on the important question of whether the lesion is of an intrinsic or extrinsic nature. Flat films taken after the first twenty-four hours will usually show air distention, and, if taken with the child upright, may reveal fluid levels in the stomach and proximal segment of the duodenum, regardless of the extrinsic or intrinsic nature of the lesion. Presence or absence of air deposits in the distal segment may help to distinguish between incomplete and complete obstruction. In atresia and aplasia, as well as in severely stenosing annular pancreas (7), the characteristic hourglass configuration of stomach and proximal segment of the duodenum may be evident on the first routine recumbent flat film, if these structures happen to be empty of fluid and contain a sufficient amount of air (Case 3). Hicken *et al.* (10) recommend taking upright and inverted flat films to facilitate recognition of a fixed anomaly by observing the position of the gastric air bubble. The inverted position has also been used by Ladd and Gross (14) and Kautz *et al.* (13) to demonstrate fluid levels in the lower abdomen and air pockets in the pelvic area in cases of atresia. It is conceivable that in cases of duplication cyst of the duodenum a conspicuous air-free area may suggest the presence of such a lesion.

However informative flat film findings such as those just enumerated may seem, their reliability cannot be matched with that of carefully conducted contrast studies. That air inflation as a means of contrast examination is valuable in duodenal obstruction has recently been demonstrated by Mellins and Milman (15). These authors insert a Levine tube, remove the stomach contents by suction, and then inject 60 to 90 c.c. of air under fluoroscopic guidance, followed by spot-filming. This procedure is no doubt safer than the use of a barium mixture, and it is hoped that further experiences with the method may prove its reliability.

In a search of the literature for well documented reports on barium studies in duodenal obstruction, it becomes obvious that the general hesitancy to use barium in suspected cases has severely restricted the activity of the roentgenologist in this particular field.

Probably because of its relative frequency among obstructive lesions of the duodenum, more reports have been published of duodenal atresia than of any of the other conditions. Only recently Kautz *et al.* (13) reported their clinical and roentgenologic findings in six cases of congenital duodenal obstruction, four of which were cases of atresia. These authors confirm the results of contrast studies in duodenal atresia reported by earlier observers, namely a typical hourglass appearance of the dilated stomach and proximal duo-

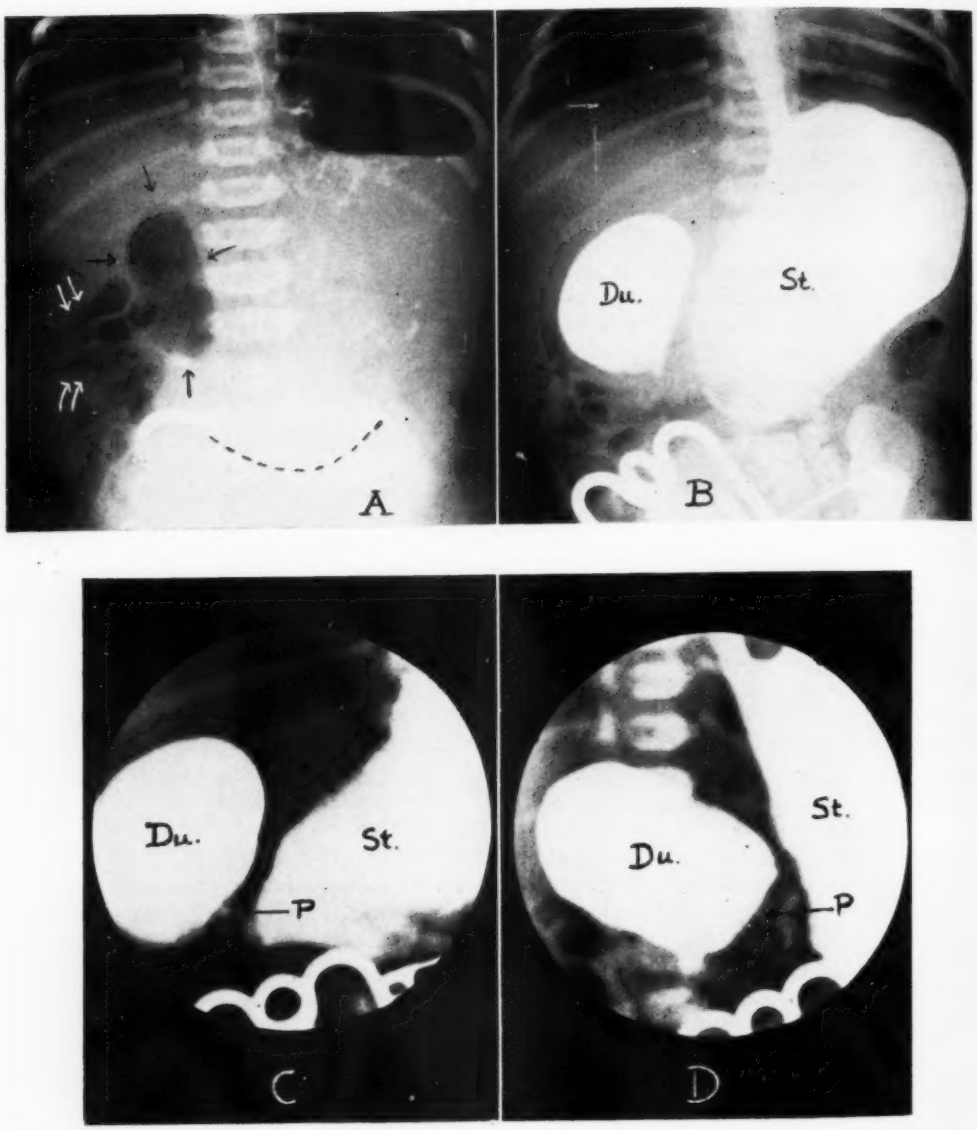


Fig. 3. Case 3. Duodenal Atresia. A. Upright film before removal of gastric contents and after ingestion of a small amount of barium. Large ovoid air deposit (black arrows) representing the distended proximal duodenum. Small air deposits in the right lateral abdomen (double white arrows) indicating incomplete obstruction.

B. Recumbent film after gastric lavage and administration of barium through a catheter, showing the characteristic hour-glass configuration of the stomach (St) and distended proximal duodenum (Du). No passage of barium beyond the proximal duodenum.

C and D. Spot films taken in the anteroposterior and right oblique positions, showing a normal pylorus and a balloon-like smoothness of the contour of the proximal duodenum.

denal segment separated by the deep pyloric constriction, a complete six-hour residue, and lack of gastroduodenal peristalsis and intestinal gas pattern. In incomplete intrinsic obstruction a similar picture is to be expected, except that an abrupt change in caliber of the duodenal lumen may be visualized and some barium

may be observed to pass beyond the obstruction, as reported by Drucker and Cohen (3) in a case of duodenal diaphragm, and by Ladd and Gross (14) in a case of duodenal stenosis. Barium studies in cases of malrotation and peritoneal band, such as reported by Caffey (2), Ladd and Gross (14), and others, are likely to reveal very much the same changes as observed in the other forms of incomplete obstruction except that the malposition of the intestinal tract may be evident and thus suggest the correct diagnosis. As a manifestation of a duodenal duplication cyst, Ladd and Gross (14) mention compression of the first and second portions of the duodenum associated with definite signs of duodenal obstruction.

From a study of the literature, including the few reports just mentioned, it appears that interpretation of the contrast findings is practically always based on evidence obtained from conventional films and that very little, if any, use has been made of fluoroscopy and spot-filming. That employment of these methods may offer a higher degree of diagnostic accuracy may be evident from the following two case reports:

CASE 3: ATRESIA OF DUODENUM: J. T. was a normally developed, full-term white baby girl. Physical examination at birth was negative. There were no palpable masses or abdominal distention. After oral feedings began, however, the baby almost continually vomited brownish granular material, occasionally red stained, containing no bile. Vomiting was not relieved by atropin sulfate. Only meconium was passed. There was occasional cyanosis, but no cough.

Clinical Impression: Congenital obstruction of pylorus or small bowel.

X-ray Examination (third day): Fluoroscopy and an upright film after administration of a minimal amount of barium mixture by bottle showed the stomach to be distended and almost completely filled with fluid. A large ovoid air shadow was noted in the right side of the mid-abdomen, and several small-intestinal air shadows were seen below this region (Fig. 3A). After removal of the gastric contents and administration of 2 ounces of barium mixture through a rubber catheter, the stomach appeared moderately enlarged and showed no peristaltic activity. Fluoroscopically and on spot films a distinct pylorus of normal length and width could be demonstrated, through which the barium passed freely into a 2.5 × 4 cm., ovoid and, as viewed from various angles, smoothly outlined structure representing the greatly dilated proximal duodenum, whose blind end was situated in the right upper abdomen (Fig. 3B and C). No barium passed beyond this structure within two hours, as determined by fluoroscopy.

Roentgenologic Impression: Subtotal atresia of proximal duodenum.

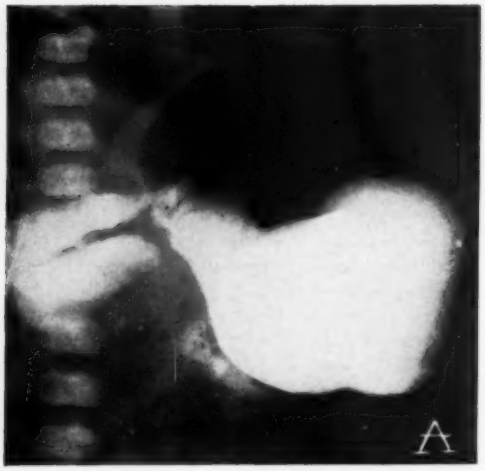
Clinical Course: On the third day a gastro-enterostomy was performed under local and drop ether anesthesia, after which the infant did well for about twelve hours. Signs of surgical shock then developed, leading to death within a few hours.

Abstract of Autopsy Report (abdominal organs only): Autopsy showed a huge dilatation of the stomach and a collapsed small intestine, suggesting that the gastro-enterostomy was not functionally open. The duodenum ended in a blind pouch about 4 cm. past the pylorus. The distal duodenum ended in a similar blind pouch, with only a few millimeters of tissue separating the two. The common bile duct opened into the distal segment of the duodenum about 1 cm. distal to the blind end.

Anatomical Diagnosis: Congenital atresia of duodenum. No evidence of other abdominal anomalies. The atresic segment was not examined histologically.

Comment: This case of duodenal atresia exhibited the pathognomonic hourglass configuration of stomach and dilated proximal duodenum with a sharp separation of these segments by the deep pyloric incisura. The diagnosis was suggested on a flat film, but conclusive evidence was obtained only from contrast studies aided by spot-filming, which revealed another characteristic finding, namely a perfectly smooth contour of the dilated proximal duodenal segment regardless of the angle from which this structure was viewed. The finding of air distal to the atresia could be explained only by the presence of fine channels in the short atresic segment, allowing passage of air but not of food. The presence of air and absence of contrast medium distal to the obstruction would seem to distinguish atresia from aplasia, but not from a severe degree of stenosis or subtotal obstruction caused by an annular pancreas.

CASE 4: MALROTATION WITH PARTIAL DUODENAL OBSTRUCTION: S. T., a normally developed, full-term white girl, exhibited at birth no abdominal



trast medium, there was no fluoroscopic evidence of distention. Milk-barium mixture given by bottle showed the stomach to be somewhat distended but in normal position, with normal peristaltic activity. An unusually large cardiac air bubble was noted. The pylorus was persistently patent and wider than usual. The first, second, and third portions of the duodenum were markedly dilated and stasis of the barium was noted in these parts (Fig. 4A). The distal end of the third portion of the duodenum tapered off into a thread-like structure about 1 cm. long, which underwent twisting motions and shifted its position proximally and distally with passing peristaltic waves (Fig. 4B and C). There was no complete obstruction to the barium flow, and intestinal loops of normal caliber filled gradually distal to the narrow segment. One hour later the stomach was about 50 per cent empty and most of the jejunal loops were filled. They were abnormally situated in the right upper abdominal quadrant (Fig. 4D).

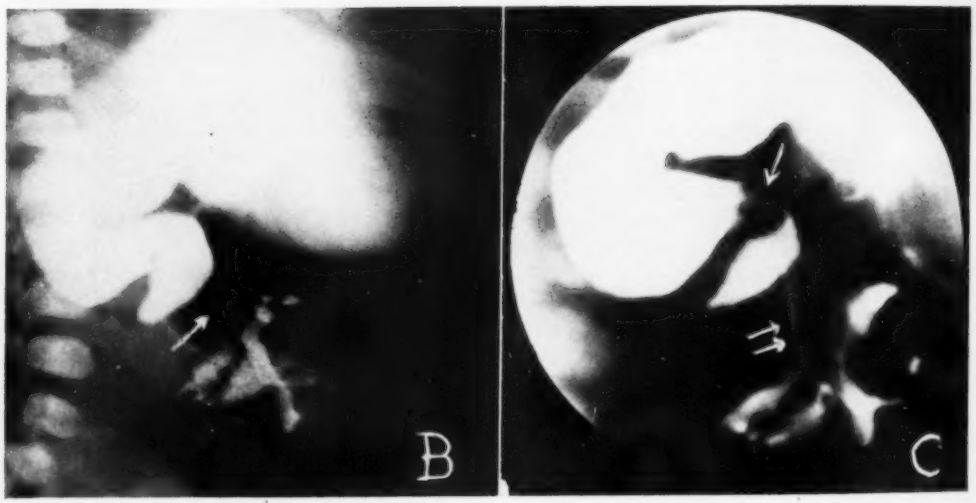


Fig. 4. Case 4. Malrotation with Partial Duodenal Obstruction. A. Right oblique roentgenogram, showing a moderately distended stomach and a considerably dilated duodenum. A small amount of barium has passed beyond the dilated segment. B. Right lateral view made shortly after A, showing a crescentic, thread-like barium shadow (arrow) between the distal end of the tortuous, dilated third portion of the duodenum and a jejunal loop of normal caliber. C. Right lateral spot film, showing an upward shift of the short, stenotic segment (arrow). Double arrows point to a string-like shadow representing the wall of the air-distended gastric fundus.

distention or mass lesion, but there was occasional visible peristalsis in the upper abdomen. The first few feedings were completely retained. Later feedings were partly retained and partly regurgitated. The vomitus always contained bile. Stools were infrequent but of normal color and consistency. This condition persisted for nine days without causing alarming weight loss (370 gm.) or marked dehydration.

Clinical Impression: Partial intestinal obstruction.

X-ray Examination (eighth day): Without contrast medium, there was no fluoroscopic evidence of distention. Milk-barium mixture given by bottle showed the stomach to be somewhat distended but in normal position, with normal peristaltic activity. An unusually large cardiac air bubble was noted. The pylorus was persistently patent and wider than usual. The first, second, and third portions of the duodenum were markedly dilated and stasis of the barium was noted in these parts (Fig. 4A). The distal end of the third portion of the duodenum tapered off into a thread-like structure about 1 cm. long, which underwent twisting motions and shifted its position proximally and distally with passing peristaltic waves (Fig. 4B and C). There was no complete obstruction to the barium flow, and intestinal loops of normal caliber filled gradually distal to the narrow segment. One hour later the stomach was about 50 per cent empty and most of the jejunal loops were filled. They were abnormally situated in the right upper abdominal quadrant (Fig. 4D). Twenty-four hours later there was no gastric or small intestinal retention, the barium having advanced into the distal colon. Additional barium was given rectally, revealing a large loop formation of the transverse part across the upper abdomen and a cecum riding high in the right upper abdomen (Fig. 4E).

Roentgenologic Impression: Partial obstruction at the duodenojejunal junction, due to volvulus or congenital bands, or both, on the basis of malrotation of the midgut.

On the tenth day the infant was transferred to

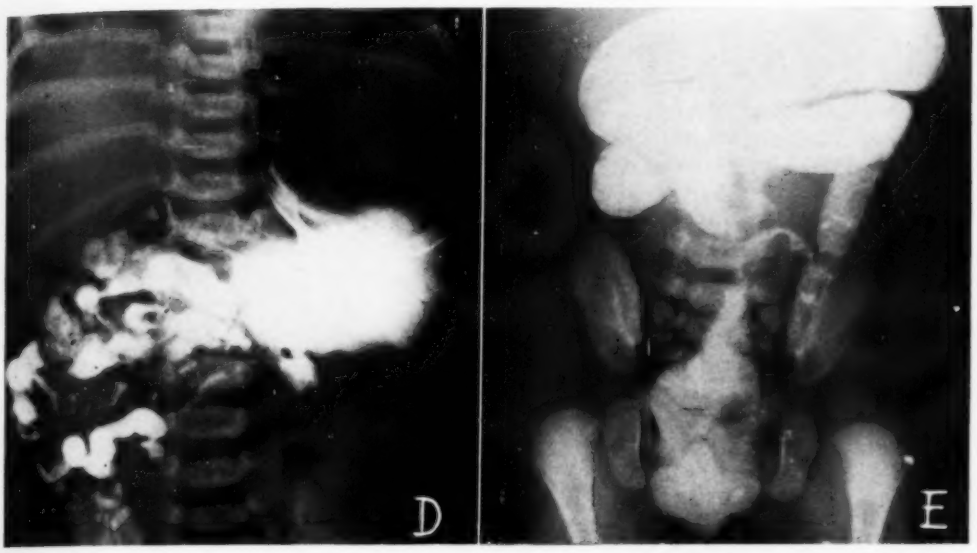


Fig. 4. D. Case 4. Postero-anterior film showing malposition of the jejunum in the right side of abdomen. E. Barium enema study revealing a high-riding cecum and abnormal looping of the transverse colon.

University Hospitals and after hydration therapy a laparotomy was performed under ether anesthesia.

Abstract of Operative Report: The stomach and entire duodenum were found to be dilated. The partially rotated cecum was adherent directly over the third part of the duodenum. A slight twist of the small intestine was present but not sufficient to interfere with the blood supply. The ileocecal region and ascending and transverse colon were then mobilized from the duodenum and mesentery and reflected to the opposite side, permitting excellent exposure of the third part of the duodenum. After severance of a few more adhesions, the obstruction appeared to be completely relieved and the intestines were returned to the abdominal cavity.

Operative Diagnosis: Partial rotation of cecum with partial duodenal obstruction. Adhesions.

Subsequent Course: Uneventful recovery.

Comment: Clinical symptoms in this case suggested partial intestinal obstruction, the nature, extent, and level of the lesion remaining obscure. Clear-cut evidence of the exact nature of the partial obstruction was obtained by contrast studies including fluoroscopy, spot-filming, and radiography. The evidence of malrotaton of the midgut as manifested by jejunal malposition was augmented by the colonic finding of a high-riding cecum. The roentgen findings indicated that bowel resection would probably not be necessary and a favorable prognosis therefore seemed justified. This impression was confirmed on operation.

Important roentgen findings obtained from contrast studies:

1. Evidence of malrotation. Right-sided position of jejunum, high-riding cecum.
2. Relaxation of pylorus.
3. Duodenal dilatation and stasis.
4. Gradual narrowing of the duodenal lumen at the site of obstruction.
5. Point of obstruction demonstrated as a short, string-like segment which shifts its position with passing peristaltic waves.
6. Twisted appearance of distal duodenum.
7. Passage of barium beyond the point of obstruction into loops of normal caliber.

JEJUNUM AND ILEUM

Differential diagnosis of congenital obstructive lesions of the small bowel distal to the duodenum involves an even greater variety of conditions than are encountered in the duodenum. In addition to lesions that occur at any level of the alimentary

tract, such as aplasia, atresia, stenosis, and duplication cyst, consideration must be given to such diverse possibilities as mesenteric and omental cyst, Meckel's diverticulum with obstructing band, volvulus, herniations of various kinds, extrinsic tumors, and the important entity of pancreatic insufficiency (meconium ileus). On a clinical basis, an extrinsic etiology may be assumed when a picture of incomplete obstruction is associated with a palpable tumor, a situation likely to be encountered in omental, mesenteric or duplication cysts, and tumors. Incomplete obstruction in the absence of a palpable mass should bring to mind stenosis, volvulus, or hernia. Intrinsic obstruction is usually suggested by the picture of complete occlusion. For practical purposes, only three conditions are to be considered in this group, aplasia, atresia, and meconium ileus. Recognition of the latter is facilitated by the concomitant manifestations of pulmonary disease. While thus a differentiation of extrinsic against intrinsic and of incomplete against complete obstruction is clinically possible to a certain degree, accurate localization of the lesion is seldom achieved, owing to the unreliability of estimating the intestinal level by the amount of distention present.

The use of flat films as a means of confirming the clinical impression has become a matter of routine. The information derived from such films, however, only rarely adds significant data beyond the evidence of juxtaduodenal obstruction which is characterized by air distention and fluid levels in the proximal segment, a finding common to all types of obstructive lesions. Keeping in mind the limitations of flat-film interpretation mentioned in the general discussion, it is sometimes possible to judge the level of obstruction from a synopsis of films taken in the recumbent, upright, and inverted positions, both in the anteroposterior and lateral projections. Upper jejunal obstruction, for instance, may be indicated by dilatation of only two or three loops, while multiple loop distention with correspondingly more extensive fluid level formation points to a more distal location of the obstruction. As Ladd and Gross state, it is impossible to differentiate between a low ileal and a colonic obstruction by flat films. Needless to say, the greatest difficulties are met with in trying to interpret plain films in cases of incomplete obstruction.

Occasionally, however, flat-film findings may be of decisive value if, for instance, a bulbous terminal loop is outlined, indicating atresia or aplasia; if a mass lesion is suggested by the finding of a conspicuous air-free area; or if the presence of intestinal structures in the chest points to a diaphragmatic hernia. As characteristic for meconium ileus, Neuhauser (16) has recently reported the following flat-film findings: a picture of small bowel obstruction which lacks the usual abrupt termination of the air column, and the presence of minute air bubbles scattered throughout the loops distal to the distended segment.

What has been said about the use of contrast media in the presence of duodenal obstruction applies to an even greater extent in the field of jejunal and ileal obstructive lesions. For reasons previously mentioned, barium studies are seldom carried out and the exact nature and level of the lesion are usually not recognized until the abdomen has been opened.

Unless repeated fluoroscopy and fluorography are employed to demonstrate the point of obstruction and to ascertain the exact nature of the lesion, the results of barium studies are apt to be disappointing, since the only information gained may be progressive dilatation and stasis of barium in the proximal loops, which are manifestations of obstruction seen in any kind of small intestinal blockage, including meconium ileus (12). While in suspected low atresia the potential dangers of prolonged barium studies seem to prohibit any effort at establishing an accurate preoperative diagnosis (however informative such efforts may be, as illustrated by Case 5), we should not be too hesitant to use barium in cases where the clinical picture definitely indicates incomplete obstruction.

Cases 6 and 7 demonstrate how much knowledge may be gained from such intensified contrast studies, without seriously hampering the chances of postoperative recovery.

Occasionally it may be desirable to rule out a high colonic atresia or stenosis, a condition most difficult to distinguish clinically from low ileal obstruction. A barium enema will readily provide the answer, but, as Ladd and Gross emphasize, its use is contraindicated in the presence of marked distention, because of the added distress to the infant.

The problem of multiple small bowel atresia is obviously a purely surgical one, since roentgenologic evidence of obstruction will be limited to the segment above the most proximal defect.

Perhaps the roentgen diagnosis of congenital small intestinal obstruction will be more often attempted and more readily accomplished when filling of the proximal loops with barium is avoided by inserting a small Miller-Abbott tube and injecting contrast medium directly into the obstructed segment. This method has been successfully used by Caffey (2) in acquired obstruction during the first few months of life, and the feasibility of adapting it to the study of congenital obstruction in the newborn seems obvious.

CASE 5: APLASIA OF SEGMENT OF ILEUM: G. L., a full-term white boy, appeared to be entirely normal at birth. Feedings were retained for about twelve hours. From then on, practically every feeding was regurgitated, but not always immediately after ingestion. The vomitus always contained bile and was of a dark brown color. No normal stools were observed. Several mucous plugs were removed by enema and manually. On the second day abdominal distention developed and prominent veins appeared on thorax and abdomen. A moderate weight loss occurred (70 gm. in two days).

Clinical Impression: Small bowel obstruction.

X-ray Examination (third day): A supine flat film (Fig. 5A) showed a gas-filled stomach of normal size in a transverse position, and several markedly gas-distended intestinal loops across the mid-abdomen. An upright flat film (Fig. 5B) showed a 4-cm. fluid level in one of the distended loops in the left middle abdomen and several smaller fluid levels nearby. There were no gas shadows in the lower abdomen.

Contrast studies (barium-formula mixture administered by catheter) showed a normal esophagus and stomach, except for a high position of the latter. The duodenum filled readily and was of about normal caliber. The jejunal passage was greatly retarded and peristaltic activity was practically absent. The lumen of the jejunum gradually increased in width, and stasis became more marked the farther the barium progressed, until a complete stop was reached in the proximal portion of a greatly dilated gas-filled loop which extended across the mid-abdomen from left to right (Fig. 5C). Twenty hours later, scattered deposits of barium had appeared in the apparently blind end of this loop, which had a bulbous appearance and measured about 2.5 cm. in diameter (Fig. 5D). A small amount of barium administered rectally progressed to the mid-transverse colon and was immediately expelled, revealing no abnormality in the parts visualized.

Roentgenologic Impression: Complete obstruction in distal jejunum or proximal ileum, probably atresia.

On the fourth day, laparotomy was performed under ether anesthesia.

Abstract of Operative Report: On opening the peritoneum, a small amount of turbid fluid was found. Exploration of the entire small intestine showed a greatly distended loop (lower jejunum?) ending blindly in the right side of the abdomen. The tip of this proximal loop appeared gangrenous and showed a minimal perforation. The loop was completely separated from the adjacent small bowel, which also had a blind end and appeared to be collapsed but of normal caliber. A cleft was seen in the mesentery attached to the separate segments.

The gangrenous tip of the proximal segment was resected after removal from the distended loop, by gentle massage, of a large amount of dark green inspissated material containing some barium. A side-to-side anastomosis was then performed.

Postoperative Course: The temperature rose steadily up to 39° C., the abdomen becoming distended. Signs of shock developed and the infant died about sixteen hours following surgery.

Final Anatomical Diagnosis: (1) Agenesis of segment of proximal ileum; cleft of mesentery; short small intestine; acute fibrinopurulent peritonitis with adhesions; marked dilatation, edema, focal hemorrhage, and hyperemia of proximal portion of small intestine. (2) Partial fetal atelectasis with aspirated material in bronchi and alveoli.

Comment: A presumptive diagnosis of small-intestinal obstruction was indicated clinically and on the flat film, but accurate localization and degree of obstruction were evident only from contrast studies, without, however, permitting a differentiation between atresia and aplasia. While the presence of barium in the obstructed loop

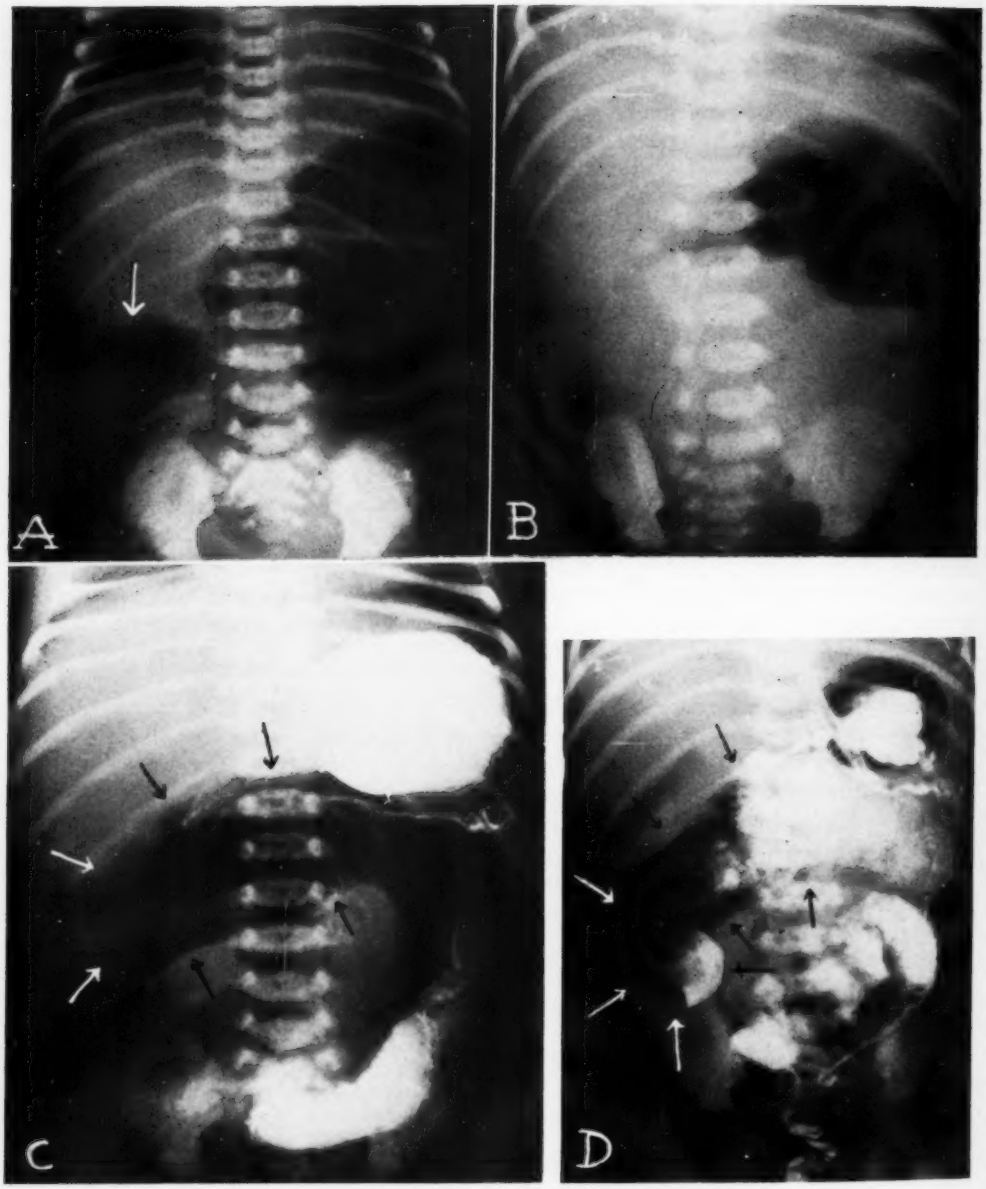


Fig. 5. Case 5. Aplasia of a Segment of Ileum. A. Supine flat film showing air-distended intestinal loops across the mid-abdomen. The globular air shadow on the right (arrow) suggests a terminal loop. B Upright anteroposterior flat film showing air distention and fluid levels limited to the left upper quadrant. Absence of air shadows in the lower abdomen suggests complete obstruction. C. Anteroposterior roentgenogram made about two hours after barium meal, showing considerable gastric retention and stasis of barium in a dilated small intestinal loop in the left lower quadrant. The large terminal loop (arrows) is still free of barium. The linear barium shadow just below the stomach and in the left lateral abdomen represents the collapsed colon following expulsion of a barium enema. D. Anteroposterior roentgenogram made twenty hours after barium meal, showing scattered barium deposits in the terminal loop (arrows), beside retention of barium in stomach and jejunum. Apparently there was no passage of barium beyond the blind end.

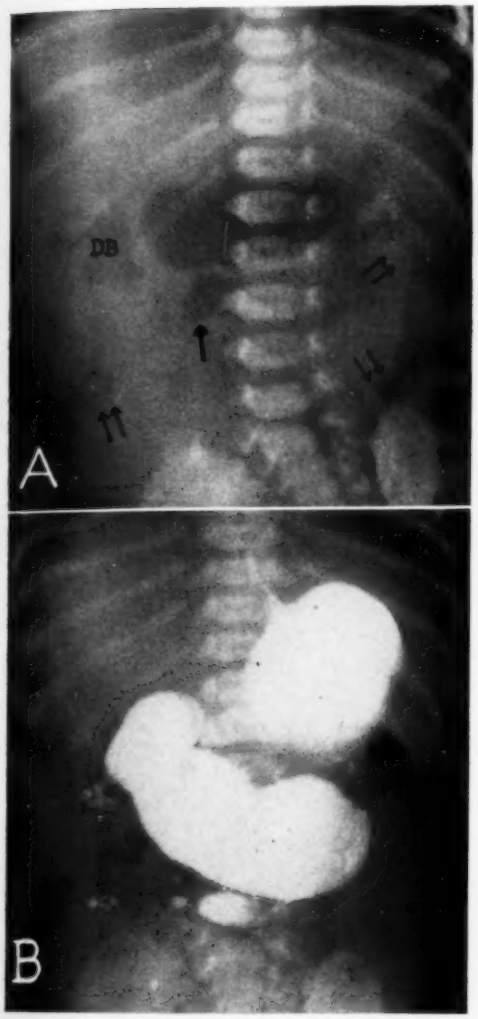


Fig. 6. Case 6. Incomplete Atresia of Proximal Jejunum. A. Supine flat film, showing moderately distended duodenal bulb (DB) and horizontal air column representing slightly distended distal duodenum (single arrows). Small scattered air deposits in distal intestines, indicating incomplete obstruction (double arrows). B. Supine film two hours after barium meal, showing marked dilatation of duodenum and proximal end of jejunum. Small specks of barium are seen distal to the obstruction.

probably played no part in the development of gangrene and perforation, the operative delay caused by the time-consuming barium studies certainly lessened the chances of postoperative survival of this infant.

Fig. 6. C. Case 6. Left lateral spot film taken before barium has passed beyond the obstruction, showing smooth, globular configuration of the obstructed segment, suggesting complete atresia.

Important roentgen findings obtained from contrast studies:

1. Progressively more marked dilatation and lack of motility of intestines from the upper jejunum down to the point of obstruction.
2. Demonstration of a terminal loop with a blind, bulbous end.
3. Fragmentation of barium in the terminal loop suggesting that the barium has entered inspissated material contained in this loop.
4. No passage of barium beyond the blind end.

CASE 6: INCOMPLETE ATRESIA OF PROXIMAL JEJUNUM: E. M., a white baby girl, appeared to be perfectly normal at birth but soon afterward began to regurgitate all of her feedings. The vomitus contained bile and was of a greenish-yellow color. There were no stools on the first day, but later scanty stools having normal color and containing bile were passed. There was no intestinal distention during the first three days and no abdominal mass was palpable. A mild degree of dehydration developed during this time.

Clinical Impression: Partial intestinal obstruction.

X-ray Examination (third day): A supine flat film (Fig. 6A) of the abdomen showed no evidence of gastric dilatation. The duodenal bulb was outlined by its air contents and appeared to be moderately

dilated. There was a horizontal air shadow 1 cm. wide just below the stomach, suggesting a somewhat distended distal duodenum. Several small air shadows were seen in the right and left lateral parts of the abdomen. No mass was outlined.

An upright abdominal flat film was negative for fluid levels.

After bottle feeding of a barium-formula mixture, the esophageal passage appeared to be normal. The stomach was of normal size and configuration. The barium immediately entered the duodenum through a widened pylorus and filled a considerably enlarged duodenal bulb. From here on, the passage of the barium was considerably slowed down, stopping completely just beyond the third portion of the duodenum. The entire duodenum and the proximal end of the jejunum were greatly dilated and terminated in a well rounded globular structure (Fig. 6C). This finding persisted for about two hours. Fluoroscopy and films made at this time showed a minimal amount of barium to have passed beyond the obstruction (Fig. 6B). The exact point of obstruction could not be identified, the terminal segment retaining its smooth contour as viewed from various angles. A four-hour check-up showed no further passage of the barium beyond the obstruction. Most of the barium was subsequently removed from the stomach and duodenum by catheter.

Roentgenological Impression: Subtotal obstruction, probably incomplete atresia or marked stenosis, in the proximal jejunum.

After hydration therapy, operation was performed on the fourth day, drop ether anesthesia being used.

Abstract from Operative Report: On opening the peritoneal cavity through an 8 cm. hockey-stick incision in the left upper abdomen, the stomach was found to be normal. The distal two-thirds of the duodenum and the proximal 3 cm. of the jejunum were markedly dilated, terminating abruptly in a band-like, atresic segment, 3 mm. long, contiguous with jejunum of normal caliber. An attempt at forcing air and bowel contents through the stenotic segment was unsuccessful. Following application of clamps across the dilated segment and across the atresia, the prestenotic segment was incised, revealing a minute channel in the atresic part, which barely admitted a 20-gauge needle. A jejunojejunostomy with a one-finger wide stoma was then performed. There was practically no retention of barium in the bowel segments explored at operation.

Operative Diagnosis: Congenital atresia of proximal jejunum (incomplete).

Postoperative Course: The baby regurgitated some of her feedings for three more days, after which time all of the feedings were retained and normal stools were passed. On the tenth postoperative day a pneumonic process developed in the right upper lung, which responded to penicillin. A flat film of the abdomen taken at this time revealed a perfectly normal intestinal gas pattern. At this writing the infant is asymptomatic and developing in a normal manner (two months after operation).

Comment: This case was of particular interest because the clinical and flat-film findings suggested an incomplete obstruction which seemed to present no emergency situation. Barium studies based on fluoroscopy, however, revealed a practically complete obstruction exhibiting roentgenologic features consistent with the diagnosis of incomplete atresia, severe stenosis, or diaphragm. Immediate surgical intervention therefore was indicated. The preoperative information as to exact location and extent of the lesion was of decided value in choosing the surgical approach.

CASE 7: DUPLICATION CYST OF JEJUNUM: St. B., an apparently normally developed, full-term white girl who showed no evidence of respiratory disturbance or abdominal abnormality at birth, vomited dried blood during the first twenty-four hours and later regurgitated her formula about three times a day. The vomiting occurred not after every meal and was not projectile in character; its frequency was not affected by a change in formula. The vomitus contained bile. The bowel movements were of normal frequency and appearance. On the seventh day a movable mass was discovered in the lower abdomen. The weight loss was 530 gm. during the first six days.

Clinical Impression: Alimentary obstruction probably below the pyloric level. Abdominal mass.

X-ray Examination (seventh day): A flat film taken in the supine position showed several moderately gas-distended intestinal loops throughout the abdomen. No mass was outlined (Fig. 7A).

After bottle feeding of barium-milk suspension, the stomach appeared somewhat larger than usual. It was situated high in the left upper abdomen. The duodenum filled immediately and was considerably dilated throughout, its descending part being somewhat displaced to the left. The upper jejunal loops were dilated. The progress of the barium column was markedly slowed down in these parts, and there was a complete stoppage of the flow in the mid-jejunum for about an hour, after which some barium passed into the distal jejunal loops. One of these, situated in the right lateral abdomen, had a persistently narrow, semicircular appearance and enclosed a barium-free area of slightly increased density measuring about 4 × 4 cm. (Fig. 7B), corresponding to a quite freely movable, rather firm palpable tumor. Pressure applied upon this lesion by palpation or compression cone caused the barium-free area to increase somewhat in size and the surrounding intestinal loop to become thinner and more elongated (Fig. 7C). A small amount of barium passed beyond the

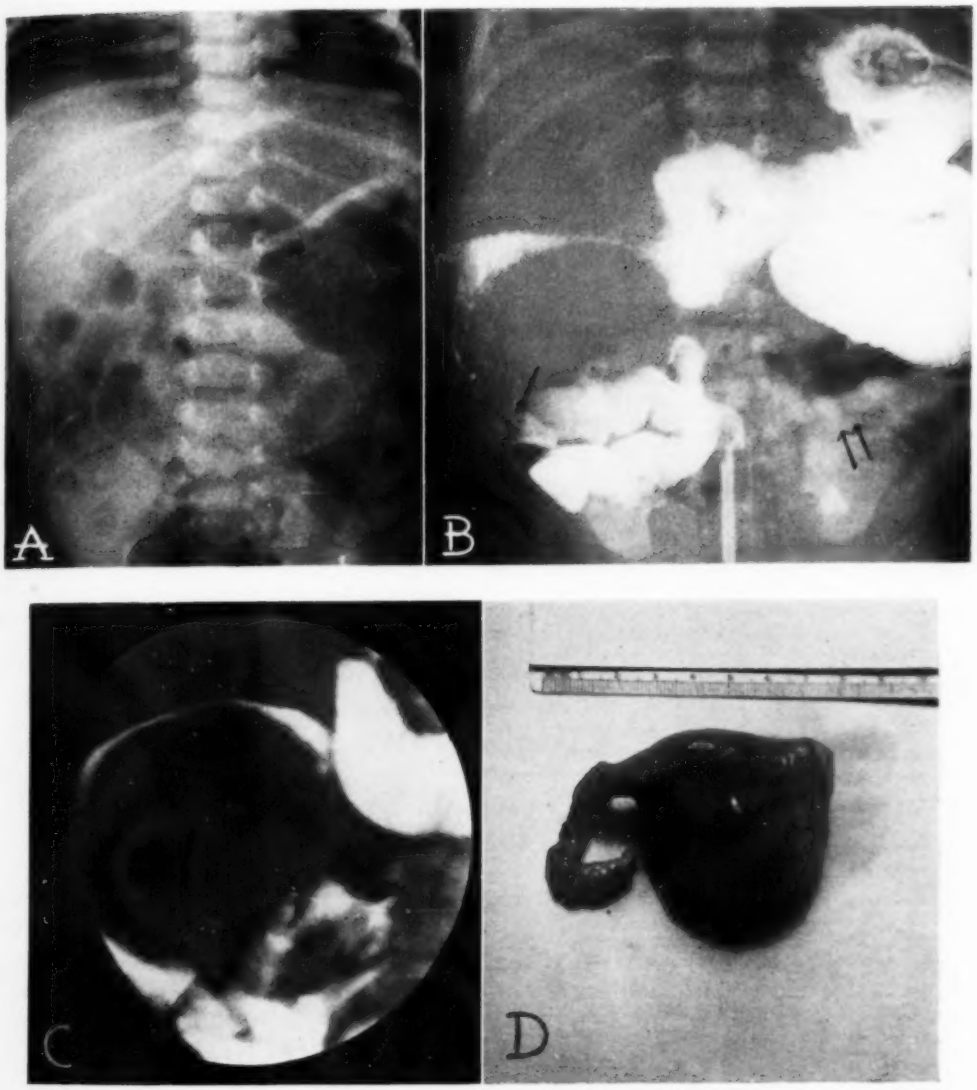


Fig. 7. Case 7. Duplication Cyst of Jejunum. A. Supine flat film showing moderately air-distended intestinal loops throughout the abdomen. No mass lesion is outlined. B. Anteroposterior film made about one hour after barium meal, showing dilatation of and stasis in duodenum and several loops of jejunum. Narrow semicircular loop in the right side, enclosing barium-free area, suggesting an extrinsic mass. Arrow points to proximal end of stenotic segment. Double arrows point to small barium deposits in small bowel loops distal to the obstruction. C. Anteroposterior spot film made with compression cone, showing a more complete demonstration of a spherical mass, and more marked thinning of the surrounding loop as a result of pressure, suggesting close attachment of the mass to the adjacent intestinal segment. D. Photograph of surgical specimen consisting of a segment of jejunum, 12.5 cm. long, to which is attached a cystic structure measuring 4.5 cm. in diameter. Note intimate relationship between cyst and intestine. Mesenteric blood vessels may be seen running across the surface of the cyst and the attached loop of intestine.

stenotic segment into loops of apparently normal caliber.

Roentgenologic Impression: Partial obstruction of the jejunum, due to a mass, probably of cystic character, in the right side of the abdomen, closely attached to the adjacent intestinal loop. Enteric or mesenteric cyst must be considered.

On the eighth day laparotomy was performed under drop ether and local anesthesia.

Abstract of Operative Report: After a right rectus

incision, a cystic mass about 5 cm. in diameter was found in the mesentery of the distal jejunum with a loop of jejunum quite adherent and possibly incorporated in the cyst wall. Separation of the mass from the jejunum was not attempted. After resection of the jejunal segment attached to the cyst, an end-to-end anastomosis was performed.

Operative Diagnosis: Mesenteric cyst or reduplication of jejunal loop.

Pathological Report: The specimen consisted of a portion of intestine measuring 12.5 cm. in length and 0.8 to 1.0 cm. in diameter. Attached to the mesenteric aspect of the intestine was a spherical structure 4.5 cm. in diameter. This had a glistening reddish-gray inner surface and a firm yellow wall 2 mm. in thickness. The adjacent intestine was compressed by the cystic structure. The outer surface of the cyst and the outer surface of the intestine were continuous (Fig. 7D).

Microscopically, sections of the cystic structure showed it to have distinct coats like those of the gastro-intestinal tract. There was a distinct mucosa and a thick muscularis. The lining epithelium was in general of high columnar type. The nuclei of the cells were basally situated. The mucosal glands were lined with similar epithelium. In general, the mucosa was more like that of stomach than intestine, but there were no identifiable large eosinophilic cells.

Diagnosis: Gastric cyst of mesentery (enteric cyst).

Subsequent Course: Wangensteen suction and glucose infusion were continued for two days, no food being regurgitated during that time. The temperature reached 40° C. on the second postoperative day and continued to fluctuate between 37° and 39° C. The stools were scanty, containing blood and mucous plugs. After the fourth postoperative day there were no bowel movements for twenty-four hours, and every feeding was regurgitated.

X-ray Examination (fifth postoperative day): A flat film showed a moderate air distention of the stomach and marked air distention of several intestinal loops in the upper abdomen. There was no retention of barium from the previous meal. A small amount of barium-milk mixture was given orally, outlining the distended stomach and upper jejunal loops, but failing to pass into the distal jejunum. Twenty-four hour check-up showed no barium in the intestinal tract, the entire meal having been vomited.

Roentgenologic Impression: Jejunal obstruction, probably at the site of resection.

Subsequent Course: After change of formula from skimmed milk to Similac and Karo, vomiting stopped almost immediately and greenish-yellow stools were passed. The temperature gradually became normal and the baby started to gain weight. She was discharged from the hospital on the nineteenth day. No further complaint occurred and she is now one year old and normally developed.

Comment: The exact nature and location of the obstructive lesion, obscure clinically and on flat-film examination, could be ascertained by fluoroscopic observations with a contrast medium. The roentgen evidence of close attachment of the cyst to the adjacent bowel loop indicated that intestinal resection would probably be necessary.

Important Roentgenologic Findings Obtained by Contrast Studies:

1. Duodenal and jejunal dilatation and stasis.
2. Ring-like, narrow loop of jejunum surrounding barium free area.
3. Palpable, movable mass lesion corresponding to this area.
4. Inability to separate circular loop from the mass lesion.
5. Enlargement of barium-free area and thinning of loop upon pressure, suggesting cystic rather than solid lesion.
6. Passage of barium beyond the obstructed segment.

SUMMARY AND CONCLUSION

Prognosis of congenital alimentary obstruction depends largely on prompt and accurate preoperative diagnosis.

The clinical picture usually allows differentiation between complete and incomplete obstruction, but only rarely yields definite clues as to the character and exact level of the abnormality, particularly in lesions situated in the segment between the pylorus and rectum.

The pertinent clinical data of the more common congenital obstructive lesions are presented in two tables, a division being made into total or subtotal and incomplete or intermittent obstruction. These tables are intended to provide the roentgenologist with a guide to preliminary classification and to facilitate his choice of further diagnostic procedure.

In discussing roentgenologic methods employed today and x-ray findings obtained on examining lesions of various kinds and at various levels (excluding esophageal and rectal obstruction), the

difficulties of flat-film interpretation are emphasized and the pros and cons of barium studies are evaluated.

In cases of suspected complete obstruction beyond the duodenum, oral administration of barium is not advisable, since it may entail an unwarranted delay in surgical intervention and lead to preoperative and postoperative complications.

In cases of incomplete obstruction at any level, carefully conducted contrast studies may yield invaluable information without endangering the patient.

The accuracy of roentgen diagnosis of gastro-intestinal obstruction in the newborn can be greatly enhanced by basing the diagnostic procedure on fluoroscopy and by making considerate use of fluorography (spot films).

Seven cases of congenital obstruction are presented in which barium studies led to a correct diagnosis: hypertrophic pyloric stenosis, pyloric spasm, duodenal atresia, malrotation with partial duodenal obstruction, aplasia of segment of ileum, incomplete atresia of the proximal jejunum, duplication cyst of the jejunum.

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SUMARIO

Diagnóstico de la Obstrucción Congénita del Estómago y el Intestino Delgado en el Recién Nacido

El pronóstico de la oclusión congénita del tubo digestivo depende en gran parte de la rapidez y exactitud del diagnóstico preoperatorio. El cuadro clínico suele permitir la diferenciación entre la obstrucción completa e incompleta, pero muy rara vez aporta claves precisas con respecto a la naturaleza y nivel exacto de la anomalía, en particular en las lesiones situadas en el segmento entre el píloro y el recto.

En dos tablas preséntanse los datos clínicos pertinentes para las lesiones oclusivas congénitas más comunes, dividiéndose la oclusión en: (1) total o subtotal, y (2) incompleta o intermitente. Esas tablas tienen por fin ofrecer al radiólogo una guía para la clasificación preliminar y para facilitar su elección de otros procedimientos de diagnóstico.

Al discutir las técnicas radiológicas em-

pleadas hoy día y los hallazgos roentgenológicos obtenidos al examinar lesions de varios géneros y a varias alturas (exclusive de obstrucción esofágica y rectal), recálcanse las dificultades que entraña la interpretación de las radiografías planas y se valúan los pros y los contras de los estudios con bario.

En los casos de obstrucción incompleta a cualquier altura, los estudios con medios de contraste, llevados a cabo con cuidado, pueden suministrar valiosa información sin peligrar al enfermo.

Basando el procedimiento de diagnóstico en la roentgenoscopia y utilizando discretamente la fluorografía (radiografías instantáneas), puede acrecentarse considerablemente la exactitud del diagnóstico roentgenológico de la oclusión gastrointestinal en el recién nacido. Preséntanse siete casos de oclusión congénita en los que los estudios con bario condujeron al diagnóstico acertado: estenosis hipertrófica del píloro, espasmo pilórico, atresia duodenal, malrotación con obstrucción parcial del duodeno, aplasia de un segmento del ileon, atresia incompleta de la porción proximal del yeyuno, quiste duplicado del yeyuno.

Diagnosis of Hypopituitarism Associated with Chromophobe Tumor (Presumed or Verified)[1]

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THE CLINICAL manifestations of pituitary chromophobe tumor may be divided into those due to pressure or extension of the tumor to adjacent areas, and those due to pressure upon the pituitary gland itself, resulting in variable degrees of hormonal deficiency.

It is unfortunate that the majority of persons with symptomatic chromophobe tumors first seek advice because of visual disturbances. The latter consist of blurring of vision, reduction in visual acuity, or partial loss of sight due to bitemporal hemianopsia or other field defects. Careful inquiry often reveals that other symptoms preceded the change in vision. Had these preliminary and warning signs been heeded earlier, irradiation might have saved many from serious visual defects which, in some cases, may lead to complete blindness.

In addition to visual disturbances which result from local pressure, there may be other evidence of expanding tumor. Headache, for example, would naturally be expected to occur more frequently than changes in eyesight, but actually less than 50 per cent of these patients complained of this symptom. There is no constant pattern of headache as regards location, frequency or severity. Even migraine-like headaches may occur, which may or may not be a coincidence. Although signs or symptoms of neurologic nature are not common with chromophobe tumors, they do occur, consisting of drowsiness, temperature variations, convulsive seizures, personality changes, memory loss, visual hallucinations, paresthesias—in fact, we presume that almost any abnormality which might accompany intracranial disease and pressure is possible. In two instances we have observed insomnia as the chief complaint which was relieved by irradiation. Any sign or symptom suggesting extension of the tumor is a clear indication for a pneumoencephalogram. In fact, the radiologist should prefer having such a study in the majority of cases before beginning roentgen therapy.

The diagnosis of chromophobe tumor by the clinician is usually made on the basis of an enlarged sella plus consistent visual disturbances or evidence of hypopituitarism or both. An enlarged sella without visual disturbances or signs of hypopituitarism is rarely diagnosed as being due to chromophobe tumor unless it is referred to as inactive or burned out. We believe that there exist a much larger number of chromophobe adenomas than is generally believed, many of which might be termed subclinical, as suggested by Costello (1). In 25 per cent of 1,000 autopsied cases he found pituitary adenomas from 1 mm. in diameter up to a size which replaced the entire anterior lobe. Thus, in some cases there may be no hormonal change as long as there is sufficient normally functioning pituitary tissue. In others, there may be only mild degrees of pituitary failure, while in some there may be evidence of almost complete failure.

We have today numerous tests which are of great help in detecting these hormonal deficiencies, especially when clinical evi-

[1] Presented at the Thirty-third Annual Meeting of the Radiological Society of North America, Boston, Mass., Nov. 30–Dec. 5, 1947.

dence is equivocal. Before reviewing these, we should like to point out, first, that any tumor of the pituitary may, because of pressure alone, produce hormonal deficiency even though the tumor is itself hypersecretory. For example, in gigantism, which is due to a hypersecretion of growth hormone from acidophilic adenoma beginning before or during the usual age of puberty, there may be anemia, hypotension, and lack of sexual development, indicating a coexistent deficiency of other pituitary hormones. Secondly, in what we consider clinically to be a chromophobe tumor, histologic examination may reveal a mixed tumor. Thirdly, pressure on the neurohypophysis or hypothalamus may cause amenorrhea without interfering with anterior pituitary secretion. It is, therefore, not surprising that some curious hormonal contradictions may be encountered. The more important tests which are now available for clinical use may be listed as follows:

I. Thyroid function
   Basal metabolic rate, blood cholesterol, blood iodine,[2] electrocardiogram, x-ray heart
II. Adrenal function
   Cortex: Urinary 17-ketosteroids, adrenal water test, adrenocorticotropic hormone test. In addition, 11 oxysteroids,[2] sodium deprivation, fractionations of urinary 17-ketosteroids[2]
   Medulla: (Tumor), mecholyl, histamine, etamon and dibenamine tests
III. Gonadal function
   Male: Urinary 17-ketosteroids, urine assays for androgens (capon test) and estrogens, testicular biopsy, sperm counts
   Female: Urinary and blood assays for estrogen, pregnandiol, endometrial biopsy, vaginal smears
IV. Carbohydrate metabolism
   Glucose tolerance
   Insulin tolerance
   Glucose-insulin tolerance
   Inorganic phosphorus curves

Perhaps the most frequent symptom of chromophobe tumor in females under forty-five is amenorrhea. It is generally considered that without amenorrhea the existence of a chromophobe tumor, at least one producing symptoms, is unlikely. We have observed two cases, however, in which visual changes occurred with normal menstruation; the nature of the tumor was verified in both instances at operation. The onset of what appears to be the menopause without menopausal symptoms also should lead one to suspect chromophobe tumor, but here again a contradiction has been noted six times, namely the occurrence and persistence of hot flashes with amenorrhea, while in several other cases a menopausal urine and blood have been demonstrated (excess FSH). Irradiation and, in one case, surgery have not afforded relief. The chief complaint of one patient was actually persistent and severe hot flashes, and the reason for roentgenologic examination of the skull was that amenorrhea had been present for some fifteen years, beginning at the age of thirty-two.

Amenorrhea may be the only hormonal evidence of pituitary tumor in the presence of an enlarged sella. Laboratory tests may reveal a very low urinary 17-ketosteroid output (2) and absence or exceedingly low titers of FSH. Since operation is not justified in such cases, histologic verification is seldom made.

Loss of libido and potentia in the male is often an early sign and, like amenorrhea, is the reason for roentgenography of the skull. It is rare that patients with chromophobe tumors consult physicians for this symptom alone, but there is no doubt that they should be questioned regarding sex function. Loss of aggressiveness and other personality changes which occur with loss of interstitial cell function are not infrequent. In such cases the testes become hypoplastic and flabby. Testicular biopsy may show few or absent Leydig cells and hypoplasia of the tubules with little or no spermatogenesis.

Fatigability is a universal complaint; yet chromophobe tumor with hypopituitarism must always be considered as a possible cause. There are usually other signs or symptoms which suggest this possibility. A striking pallor may call attention to the anemia of normocytic type which is rather frequent when other hor-

[2] Not for routine use.

monal deficiencies exist. This can be illustrated by the case of a young man who consulted us, as he had consulted others, for anemia. Anemia was found but no cause demonstrated. He was given iron, which he had taken before, but no improvement was noted. This lack of response is typical of the anemia of hypopituitarism. Later the patient was inducted into military service, and all went well until a bitemporal hemianopsia suddenly developed. A large sella was then found on roentgenologic examination. On the patient's return for roentgen therapy, further inquiry revealed that his chief complaint originally had been fatigue, and that the finding of anemia had been a reasonable explanation to him and, no doubt, to others. The important item in the history had not been obtained because no one had asked him about sexual function, which he had completely lost.

Sexual hair, which includes body, axillary, pubic, facial and aural hair, may be completely absent, especially in patients with marked panhypopituitarism. The current conception is that sexual hair in the female is maintained by the adrenal cortex, while the beard in males and the upper part of the pubic hair is under testicular control. Males with chromophobe tumors may lose this portion of pubic hair, which then gives the appearance of female distribution. In females it has been our experience that sex hair may be present, or regrow if cut, even though the urinary 17-ketosteroids are very low. Furthermore, we have found the adrenal water test positive in such cases. When one considers that loss of axillary or pubic hair in the female is not striking in true Addison's disease, it would seem that the type of hair growth just mentioned might also be stimulated or maintained by hormones direct from the pituitary. Head hair seems to thrive in these cases although in some instances, as in primary thyroid myxedema, it is of poor texture and, what is important to the female patient, it will not take or hold a permanent wave.

The thyroid gland is hypoplastic when hypopituitarism is present. Basal metabolic rates may be very low, usually averaging around −20 per cent. In 103 of 172 cases of chromophobe tumor obtained from our files, which form the statistical data for this presentation, 30 per cent of 70 patients tested had a basal metabolic rate between −5 and +10, while 70 per cent had a basal metabolic rate below −5. In those with very low rates, there was usually considerable evidence of other hormonal deficiency.

In spite of such low metabolic rates, the patient with hypopituitarism usually has a smooth, soft skin, is often mentally alert, and does not look like a myxedematous person. The blood cholesterol is usually within normal limits (4). There are, however, exceptions in which the clinical appearance is indistinguishable from primary thyroid myxedema. The blood cholesterol is usually elevated (3). It is for this reason that all patients who have what appears to be primary thyroid myxedema should have skull roentgenograms to determine the question of pituitary adenoma. The reason for the development of myxedema in some patients is obscure; one might hypothesize that the thyroid gland was defective before the onset or one might believe in a predominant or selective deficiency in pituitary thyrotropic hormone. There is one way in which a differentiation can be made, and that is by the use of the adrenal water test. It is always positive in panhypopituitarism which masquerades as myxedema and is always negative in primary thyroid myxedema, at least in our experience.

Aneurysm of the internal carotid artery may occur in primary thyroid myxedema and, as it expands, may then depress pituitary function, or an aneurysm may press upon the pituitary of an otherwise normal individual, producing hypopituitarism or pituitary myxedema. We have observed a number of such cases.

As in many diseases, one or more of the signs or symptoms may predominate in hypopituitarism. I have already pointed out that the clinical signs may appear to be

primarily of thyroid or gonadal origin. Likewise, adrenal insufficiency simulating Addison's disease except for the typical pigmentation and black freckles may result from the pressure of a chromophobe tumor. Hypoglycemic reactions with coma may occur. In such instances, as well as in most patients who exhibit evidence of panhypopituitarism, a low blood-sugar curve is usually found on performing a glucose tolerance test, and insulin sensitivity is marked. The adrenal water test is always positive and the urinary 17-ketosteroids approach zero. The injection of adrenocorticotropic hormone (5–7) of the pituitary theoretically should provoke a positive response, but Thorn (8) states that the atrophic adrenals do not respond, thus rendering this test of value in pituitary hypofunction.

The blood pressure is low in many of these cases but, as in Addison's disease, the level found may be dependent on previous heights. This was recently demonstrated by a woman of sixty who had been known to have hypertension for some years. Bitemporal hemianopsia suddenly developed, following which the blood pressure fell to around 110, where it has remained ever since. The enlarged sella was shown by pneumoencephalography to be due to a tumor. The abrupt onset may have been due to hemorrhage within an adenoma, since partial recovery of vision took place spontaneously.

In 5 per cent of the cases in our series a blood pressure of over 140 mm. systolic was present, and in 50 per cent the systolic blood pressure was below 120 mm., regardless of age. Systolic pressures below 100 were present in about 20 per cent of the patients.

Obesity is no help in diagnosis, nor should it particularly arouse suspicion of chromophobe tumor. It is true that some patients gain considerable weight, but an equal number lose weight. In the female the distribution of fat is of no particular importance, but in the male its distribution may be like that in the female. We consider it likely that this is a result of male sex hormone deficiency rather than a direct effect of pituitary deficiency.

Chromophobe tumors in all probability may manifest themselves at any age, but we have not seen one occur before the age of thirteen. Six females and 2 males dated the onset of their trouble before the age of twenty, although only 2 were seen just before that age. Growth retardation may take place if hormonal deficiency occurs before epiphyseal closure. At that time craniopharyngioma is more likely to be the cause of dwarfing than chromophobe tumor.

The problem of early diagnosis can be partly solved if careful investigation, such as we have reviewed, is carried out whenever enlargement of the sella turcica is found. Early irradiation, we believe, is justified whenever there is reasonable evidence of early hormonal deficiency and certainly when there is suspicious visual change. It is certain that the course of a chromophobe adenoma is extremely variable, since some tumors with obvious hormonal deficiencies apparently stop growing, while others may recur rapidly even after surgical removal.

In 172 cases so far reviewed, 6 tumors are known to have recurred after operation; 4 of the patients were reoperated upon and 2 received roentgen therapy. A total of 85 patients received roentgen therapy at the outset, 4 of whom required surgery because of failure of irradiation to prevent progression of visual changes. A total of 81 patients received surgical treatment primarily. No treatment was directed toward the tumor in at least 6 cases. Our follow-up of the entire group has not been completed, but of the first 32 patients, treated over ten years ago, 23 are alive, 2 have normal vision (1 surgically treated, 1 by x-ray), 14 have improved vision, 2 have noted no change, and 2 are blind. The state of vision in 3 cases is unknown. As to the present hormonal status of these cases the data are at present incomplete.

Treatment of hypopituitarism is one of replacement so far as is possible. X-ray therapy rarely restores complete normal

pituitary function. Pituitary extracts are not satisfactory, although temporary effects have been observed following administration of thyrotropic and chorionic gonadotropins. As stated before, adrenocorticotropic extract is not effective if any degree of hypopituitarism exists (8). These extracts are expensive and not suitable for continued use.

Two synthetic substances have proved effective and convenient. These are testosterone and desoxycorticosterone. Testosterone is used in both males and females for its anabolic or building-up effect (6). In males with secondary hypogonadism from chromophobe tumor its effect on libido and potentia is often disappointing, although, as in the female, increased endurance and a feeling of well-being is experienced. The anemia is lessened in some cases. Desoxycorticosterone is also used in the more severe forms of hypopituitarism. It raises the blood pressure and appears to help in the improvement of these patients. Both preparations may be given parenterally, but the most convenient method is implantation of pellets, which may last from two to six months. Initially, 4 pellets of testosterone and 1 or 2 pellets of desoxycorticosterone are implanted (each pellet contains 75 mg.).

Desiccated thyroid in doses of not over 1 grain a day may be used after the above treatment has been instituted. We have not found it particularly helpful except in those cases which show some myxedema, but it may be given a trial in all cases. There is, however, a remote danger that it may precipitate an adrenal crisis. Adrenal cortical extract may be used, but we have not found it necessary. Control of hypoglycemic attacks can be attained with proper diet and frequent feedings.

Estrogens will provoke uterine bleeding and breast enlargement. They will not make sexual hair grow if there is no functionable pituitary tissue through which hair growth with estrogens seems to be mediated. It may cause pseudogalactorrhea. We have been suspicious that estrogens may stimulate chromophobe tumor growth or enlargement (4). In the first place, chromophobe-like tumors can be produced in certain animals with large doses of estrogens (9). We have seen a number of cases in which visual change has coincided with estrogen therapy. While we have no actual proof of cause and effect, we believe there is sufficient evidence to warrant advising against large doses in these cases.

When emaciation or pituitary cachexia exists, particular attention should be paid to adequate nutrition, especially vitamin and protein intake, by whatever route is necessary. If the patient is in a rather extreme state of cachexia, temporary use of adrenal cortical extract is probably advisable. Such cases are admittedly rare but we do not face them with such utter hopelessness as we did in the past.

SUMMARY

1. A presumptive diagnosis of chromophobe tumors rests on the finding of an enlarged sella and evidence of visual change or hormonal deficiency, or both.

2. We believe all enlargements of the sella turcica should be considered due to some abnormality whether or not there is clinical evidence of secondary effects.

3. The various methods of investigating hormonal deficiency are reviewed. These should be carried out whenever enlargement of the sella is found.

4. Visual field examinations and determination of visual acuity should be done in all cases with enlarged sellas.

5. The importance of a careful history is emphasized.

6. The variable and somewhat contradictory findings in patients with chromophobe tumor are discussed.

7. The medical treatment with synthetic and other preparations is gratifying.

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DISCUSSION

George W. Thorn, M.D. (Boston, Mass.): From the radiologist's point of view, the important aspect of the problem of the chromophobe pituitary adenoma is the fact that radiation therapy appears to be the most effective means of treating the majority of patients. From the clinical point of view it is essential to recognize that, regardless of the state of hypophyseal secretion prior to irradiation therapy, there certainly will be marked and even severe pituitary deficiency in most well treated cases. Thus to the internist the problem is almost always one of correcting multiple glandular deficiencies. The radiologist is concerned with preventing enlargement of the tumor and the development or increase of local pressure phenomena.

Reduction in over-all pituitary activity with associated thyroid, adrenal, and gonadal hypofunction does not cause as much disturbance to the patient as one might feel should occur. This is no doubt due to the fact that all functions are simultaneously reduced, and hence a deficiency of one factor is not so readily apparent. A good example is the problem of loss of libido. Patients with pituitary insufficiency rarely complain of this. The patient's spouse is most likely to bring up this problem. This is in marked contrast to the many patients without pituitary or gonadal insufficiency who complain of loss of libido which is actually due to psychological and emotional difficulties. When a patient complains primarily of loss of sexual powers, there is a high probability that this is not due to primary hormonal deficiency.

The insidious development of anterior pituitary deficiency may be brought to the attention of the physician earlier in females than in males. This is due to the fact that amenorrhea is a common and early accompaniment of loss or decrease in anterior pituitary function, and this marked change in the menstrual cycle is an obvious cause for medical consultation. Furthermore, it occurs so early in the course of pituitary insufficiency that it may prove extremely helpful as a diagnostic aid in women who have not attained the menopause.

In the past, many of these patients have not been treated adequately. Following irradiation, they have been left more or less to themselves, providing no local signs due to an expanding tumor were present. We know now that the energy, activity, and productivity of many patients can be improved measurably by providing adequate replacement hormone therapy. Theoretically, one would like to give anterior pituitary extract containing the stimulating fractions for thyroid, gonads, and adrenal, since these endocrine glands presumably are capable of responding to pituitary hormone stimulation. However, in the absence of satisfactory anterior pituitary therapy, the physician must rely on substitution therapy. At this point it is important to recognize that the three essential hormones should be given, *i.e.*, thyroid, gonadal, and adrenal. In regard to the thyroid hormone the problem is simple. One tenth of a gram of U.S.P. thyroid given once daily usually suffices. Some patients will require a somewhat larger dose. Some patients will not tolerate even 0.1 gm. if their adrenal insufficiency is marked and is not treated simultaneously. It is well in all instances to begin with relatively small doses, *i.e.*, 15 mg. daily, and to maintain a patient at this level for two weeks, increasing the dose by 15 mg. at fortnightly intervals until a total dose of 60 mg. has been attained. In elderly patients, if the metabolic level has been quite low prior to the institution of thyroid therapy, increasing the dose should be done at longer intervals to prevent the development of symptoms of coronary insufficiency. It is recognized, of course, that the maximum effect from a given dose of thyroid may not become evident for two to three weeks after the new dosage level has been attained.

Androgenic therapy for the male may be given in the form of methyl testosterone (10 mg. two or three times daily), as a weekly or twice weekly injection of 25 mg. of testosterone propionate, or as testosterone pellets implanted subcutaneously. Great improvement will follow relatively small doses of the hormone, and it is not necessary to attain a level which gives excessive and undesirable side effects. For females, estrogenic therapy may be indicated if the patient is under forty years of age.

Regarding adrenal hormone substitution therapy, there are two types of preparations which must be considered. Desoxycorticosterone acetate is a very potent salt-retaining synthetic adrenal hormone which is inexpensive and extremely effective in maintaining blood pressure and fluid volume. The

quantity of this hormone which patients with pituitary insufficiency require is usually very small. In most instances, 1 to 2 mg. daily is more than adequate, given as an intramuscular injection in oil, or the implantation of a pellet of 125 mg. will usually suffice for a period of a year. Larger doses are likely to cause edema. In many patients with pituitary insufficiency it is impossible to give an adequate dose of thyroid hormone without inducing a relative adrenal cortical deficiency. This type of deficiency is related particularly to the carbohydrate-regulating adrenal steroids, *i.e.*, 11–17-oxysteroids, and can be corrected only by the administration of whole adrenal extract. There are two types of preparation, an aqueous extract and an extract in oil. Aqueous adrenal extracts must be given twice daily and in doses from 3 to 5 c.c. at each injection. Lipo-Adrenal Cortex (Upjohn's extract in oil) may be given once daily in a dose of 1 to 2 c.c. Unfortunately the cost of whole adrenal extract makes it impracticable for most patients, since adequate dosage may cost from $5.00 to $10.00 daily. It is important, however, to recognize the fact that if whole adrenal extract cannot be given, patients can be maintained in fairly good condition with methyl testosterone and relatively small doses of thyroid and desoxycorticosterone acetate. The dose of thyroid must be modified by the adequacy of the adrenal function or availability of whole extract.

Finally, in regard to diagnosis, it is possible to use the purified pituitary adrenocorticotropic hormone as a diagnostic measure of adrenal insufficiency secondary to pituitary deficiency. In most patients with long-standing pituitary insufficiency the adrenal response to a single injection will be limited. This is measured by counting the circulating eosinophils (Thorn, Prunty, and Forsham: Tr. A. Am. Physicians **60:** 143, 1947) and estimating the changes in uric acid-creatinine excretion over a suitable interval. Normal individuals give a maximum response to a single injection of adrenocorticotropic hormone. Patients with Addison's disease give no response, and patients with pituitary insufficiency without high-grade permanent adrenal insufficiency give values between the above two groups. However, treatment with this hormone over a forty-eight to seventy-two hour period results in striking changes in patients with adrenal deficiency secondary to pituitary failure, and one thus has both a diagnostic and therapeutic weapon. It is quite possible that as the adrenocorticotropic hormone preparation becomes more readily available, a stimulating dose given at relatively infrequent intervals once or twice weekly may substitute in large measure for the more expensive whole adrenal extracts, since recent studies indicate that adrenocorticotropic hormone stimulates an outpouring of 11–17-oxysteroids from the adrenal cortex.

Dr. Hurxthal (*closing*): What Dr. Thorn says is true about the expense of the whole adrenal extract and adrenocorticotropic hormone. It often happens that the most interesting patients are the ones who cannot afford such preparations.

I have been interested in knowing what may happen to the pituitary in patients who receive large doses of androgens and estrogens. If such preparations cause enlargement of the sella, we should soon be seeing it frequently. Castration also brings up the question as to whether the recurrence of cancer might not be initiated through the adrenal cortex. After castration of patients with cancer, the urinary 17-ketosteroids fall in the male and later on are apt to rise. Castration has a stimulating effect upon the hypophysis, which may in turn cause compensatory-like secretion of adrenocortical hormones. This may account, particularly in males, for the rise in 17-ketosteroids which comes sometime after the gonads have been removed. Does recurrence of cancer of the prostate, for example, coincide with this activity? Do androgens and estrogens have a favorable influence on cancer through the adrenal cortex?

SUMARIO

Diagnóstico del Hipopituitarismo Asociado a Tumor Cromófobo

El diagnóstico presuntivo de tumor cromófobo de la hipófisis reposa en el hallazgo de hipertrofia de la silla turca y signos de alteración visual y dishormonismo, o en ambas cosas. Aun a falta de signos clínicos de efectos secundarios, parece que la hipertrofia de la silla turca debe ser considerada como debida a alguna anomalía. Hay numerosas pruebas a mano para determinar la existencia de deficiencias hormónicas cuando los signos clínicos parecen equívocos, y siempre que se descubra hipertrofia de la fosa hipofisaria, hay que aplicar las mismas, comprendiendo pruebas de las funciones tiroidea, adrenal y gonádica y del metabolismo hidrocarbonado, aunque los hallazgos pueden ser variables y a veces contradictorios. En todos esos casos, se harán exámenes de los campos visuales y determinaciones de la agudeza visual y se obtendrá una historia cuidadosa, comprendiendo la función sexual y la fatigabilidad. El tratamiento es de sustitución en todo lo posible. El empleo de testosterona y desoxicorticosterona ha resultado eficaz y conveniente.

The Diagnosis and Treatment of Pineal Tumors[1]

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PINEAL TUMORS are among the rarer forms of intracranial new growths, but during recent years we have come to realize that certain of them respond extremely favorably to either operative or roentgen therapy, or at times to a combination of the two. It is for this reason that it appears worth while to review the symptomatology and to summarize the treatment which we have found useful.

From its anatomical relationships in the brain (Fig. 1), it is evident that the pineal body lies in such a position that a tumor arising from it will ordinarily involve important structures as soon as it attains even moderate size. The most important of these structures from the clinical aspect are the corpora quadrigemina and the aqueduct of Sylvius. Pressure upon the former causes certain changes in the oculomotor apparatus, while complete or intermittent occlusion of the aqueduct results in internal hydrocephalus. The signs and symptoms referable to such pressure will be discussed under clinical symptomatology.

PATHOLOGY

So far as the pathology of pineal tumors is concerned, the so-called pinealoma is by far the most frequent type. This tumor is composed mainly of large undifferentiated cells simulating the pineal parenchyma cell, as well as small, darkly staining "lymphoid" cells, and also varying numbers of neuroglial cells, all of which are contained sometimes in a loose stroma of connective tissue, while at other times there may be heavy connective-tissue septa (Fig. 2).

The other type of pineal tumor is the teratoma. This tumor may have all the characteristics of teratomas found elsewhere in the body, or there may be obviously teratomatous elements in what appears to be largely an ordinary pinealoma, as shown by Dorothy Russell (1).

CLINICAL SYMPTOMATOLOGY

There is nothing particularly characteristic about the history given by patients harboring pineal tumors so far as any localizing significance is concerned. Headache is the chief and almost universal complaint, and its duration may have been for as brief a period as a few days or as long as a year and a half, presumably varying with the degree of compression of the aqueduct of Sylvius and the ensuing hydrocephalus. In many instances the headache is referred to the frontal area. Vomiting due to increased intracranial pressure accompanies the headaches in many patients.

In past years, before patients with intracranial tumors were referred promptly to neurologists or to neurosurgeons, failing vision and blindness were likewise distressing symptoms, but fortunately these sequelae are not seen nearly so frequently nowadays. Other less usual symptoms are those referable to secondary pressure upon the cerebellum, chiefly unsteadiness or staggering.

Another occasional complaint of patients with pineal tumors is excessive thirst and an unusually large urinary output, *i.e.*, diabetes insipidus. This has been shown to be due in some cases to involvement of the hypothalamic area by invasion of pinealoma cells (Stringer, 2; Horrax and Wyatt, 3).

NEUROLOGICAL FINDINGS

Choked disks, usually of considerable degree, are one of the chief objective features, but this condition has no localizing

[1] From the Department of Neurosurgery, Lahey Clinic, Boston, Mass. Presented at the Thirty-third Annual Meeting of the Radiological Society of North America, Boston, Mass., Nov. 30–Dec. 5, 1947.

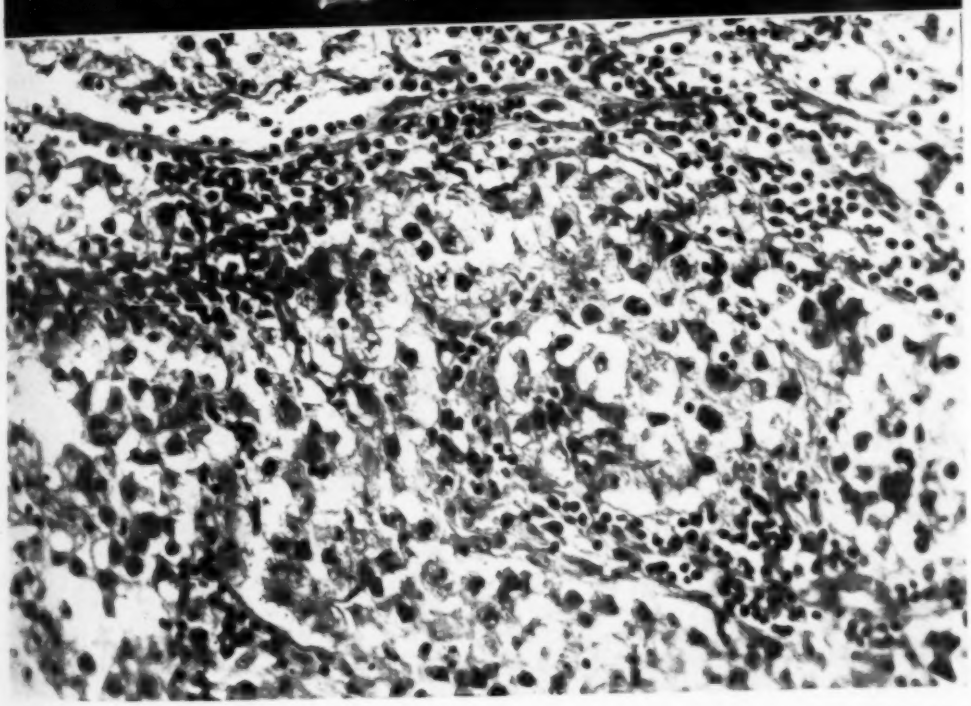

Fig. 1. Midsagittal section of the brain, showing the relationship of the pineal body (arrow) to its neighboring structures, particularly the corpora quadrigemina and the aqueduct of Sylvius.

Fig. 2. Typical histologic picture of a pinealoma, showing the characteristic large pineal parenchyma cells and the small lymphoid cells. Glial cells show only with special stains.

Fig. 3. Pubertas praecox in a child ten years of age who had a histologically verified pinealoma. (From Horrax: Arch. Neurol. & Psychiat. **37:** 385–397, 1937.)

significance. There are, however, two findings concerned with the oculomotor apparatus which, when present, are of great value in determining the presence of a pineal tumor. These are, first, the loss of conjugate movement of the eyeballs above the horizontal plane, and second, the loss of the reaction of the pupils to light in the presence of normal or nearly normal visual acuity. These features are due to pressure upon the corpora quadrigemina and subsequent involvement of the nuclei of the third and fourth cranial nerves and were present in a considerable percentage of our series (4). In addition, Dandy (5) believed bilateral ptosis to be an extremely important localizing sign when the oculomotor functions were not otherwise involved.

Other objective findings which may be present are evidences of secondary cerebellar compression, such as staggering gait, a positive Romberg with a tendency to fall backward, nystagmus, and varying degrees of ataxia in both upper and lower extremities. These, of course, do not help but tend rather to confuse the localization.

One other feature which is met with occasionally in certain patients having pineal tumors is the condition of premature sexual maturity known as pubertas praecox. Although this syndrome, when seen in conjunction with other evidences of a pineal tumor, is immediately characteristic, nevertheless, it has been noted rarely, and occurs only in some male children before the age of puberty. Because of its striking and obvious features, considerable attention has been paid to this aspect of pineal tumors in children, but examples of this hastened maturity are by far the minority of all the prepuberal cases reported (Fig. 3). In our series it was present in one out of six children under twelve years of age. It should be noted also that pubertas praecox may occur in patients having adrenal or testicular tumors or brain tumors other than those involving the pineal body.

VENTRICULOGRAPHIC DIAGNOSIS

Although a tumor of the pineal body may be strongly suspected in a patient showing the usual neurologic localizing signs along with evidences of increased intracranial pressure, nevertheless the final diagnosis in most instances must be established beyond question by a ventriculogram. Such an air study will show dilated lateral ventricles with dilatation also of the anterior portion of the third ventricle. The posterior portion of the third ventricle shows a filling defect, usually in the shape of a rounded projection which represents the anterior pole of the tumor (Figs. 4 and 5). It is possible that in rare instances a somewhat similar roentgen picture may be given by a cerebellar growth which has pushed forward into this area, but in the

vast majority of cases the combined clinical and roentgenographic findings are pathognomonic.

TREATMENT

In the presence of a known and localized intracranial tumor there are at the present time two modes of attack. In most instances the procedure of choice is complete surgical removal, which is now possible in

Fig. 4. Ventriculogram of a patient having a histologically verified pinealoma. Rounded projection of tumor into posterior portion of third ventricle (arrows). Dilated lateral ventricles.

a large percentage of patients. On the other hand, it is well known that certain growths will respond well either temporarily, or in some instances perhaps permanently, to roentgen therapy. Since a reasonable percentage of pineal tumors are known to come within this latter category, and since their operative removal is extremely hazardous, it is my firm belief that they should all be given a trial of such therapy unless critical existing circumstances demand an immediate attempt to remove the growth surgically. Such circumstances are present rarely, if ever.

It may be argued by some that any tumor should be verified histologically before being subjected to deep x-ray treatment,

Fig. 5. Ventriculogram of a patient having a presumed pinealoma in view of neurologic findings and the ventriculographic evidence of tumor in the posterior portion of the third ventricle (arrow).

and this argument is certainly true so far as cerebellar tumors are concerned, inasmuch as the differential diagnosis of tumors in the posterior fossa is never certain except by exposure and biopsy. However, in the case of pituitary adenomas and pineal tumors when the combination of clinical and roentgen findings is almost certainly characteristic, it would not appear that histologic verification is necessary. This is particularly true of pineal tumors, since even the approach to this region for the sake of a biopsy constitutes a considerable risk.

Before beginning the roentgen treatment of pineal tumors, we believe from our experience that a simple right subtemporal decompression should be carried out. This opinion has been voiced likewise by Spurling (quoted by Kahn, 6). This is indicated because most patients having these tumors give evidence of increased intracranial pressure (headaches, vomiting, choked disks), and since there is apparently some initial swelling of the tumor in the early stages of treatment, these symptoms may be increased and be extremely upsetting to the patient. With a previous decompression, the course of roentgen

therapy is almost always smooth, as noted in a previous publication (7).

Within a week or ten days after decompression, the first series of deep therapy is given. This consists in a total dosage of 3,600 to 4,000 r delivered usually through two ports, namely the temporal region of each side. This means that the total dosage received by the tumor is approximately one half this amount, or 1,800 to 2,000 r. In the great majority of our patients who have responded well to this type of therapy, a single series of roentgen treatments has been sufficient.

The patient is then checked up at frequent intervals, usually once a month for the next six months, or more frequently if choked disks do not begin to recede and the subtemporal decompression continues to bulge. In the latter event, a second series of roentgen treatments is given as soon as this can be done safely. In most instances, however, if the tumor is one which is going to respond to x-ray therapy, it will do so quite promptly, and as a rule we have had to give only one roentgen series.

If the symptoms and signs do not subside after two or possibly three series of deep therapy, an attempt at operative removal of the growth must be made. The operative mortality for the extirpation of pineal tumors is high, and successful removals with long survival have been accomplished only rarely by neurological surgeons in this country or elsewhere. However, it is an operation of necessity and last resort, if the more conservative measures just outlined have failed.

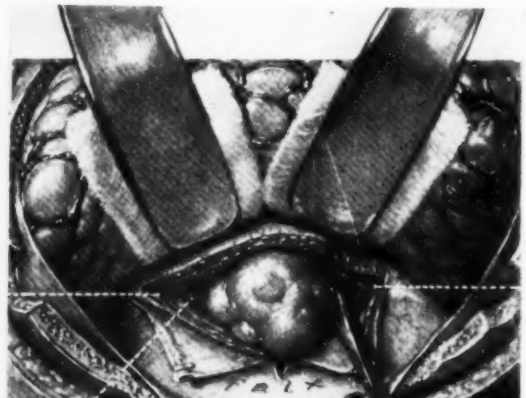

Fig. 6. Dandy's operative approach to the pineal region for the removal of tumors. The cerebral hemisphere is retracted from the falx and after splitting of the posterior end of the corpus callosum the tumor is brought into view. (From Dandy: Surg., Gynec. & Obst. **33:** 113–119, 1921.)

The details of the operative procedure do not concern us here. Suffice it to say that the usual approach is that proposed by Dandy (8), whereby one cerebral hemisphere is retracted from the falx and, after splitting of the posterior portion of the corpus callosum, the upper pole of the tumor is brought into view (Fig. 6). It is then removed either piecemeal or by suction, although in the event of a small tumor an intact extirpation may be accomplished in rare instances. When a large tumor is present, it may be necessary to resect the occipital pole of the brain in order to secure adequate exposure to deal with the tumor (9) (Fig. 7).

STATISTICS

There have been 22 patients in our series of brain tumors in whom the diagnosis of a pineal tumor has been made. In 14 instances this diagnosis has been verified histologically either at operation or at necropsy. In the other 8 patients the diagnosis has been made by the combination of localizing neurologic signs confirmed by the ventriculographic evidence of a mass projecting into the posterior portion of the third ventricle, as described heretofore.

Of the total 22 patients there were 10 who had grossly complete operative removal of their tumors. Four of these operations were undertaken because decompression followed by roentgen treatment had failed. Three patients in this group of 10 are alive and well, ten, five, and three years, respectively. One of them, however, had only an ectopic pinealoma in the chiasmal region but is included for the sake of completeness. This is the patient whose postoperative survival so far has been five years. All of the three had roentgen treatments following tumor removal.

Seven patients of those who were thus radically operated on have died. One of these lived eight years after a primary decompression and roentgen treatment, and another did extremely well for one year, both succumbing shortly after the final tumor extirpation. One other patient was well for four years after removal, elsewhere, of the pinealoma in the pineal region, but died three months after partial removal of a large extension in the chiasmal and anterior third ventricle region. No evidence of the original growth in the posterior third ventricle area was evident on a pneumoencephalogram. The remaining 4 patients died within two days to three months following operation.

Twelve patients have been subjected to a simple decompression or a biopsy of the tumor. Those who survived have been given deep x-ray therapy. Four patients in this group have had their tumors verified histologically, while the diagnosis in the other 8 rests on the neurologic and ventriculographic findings.

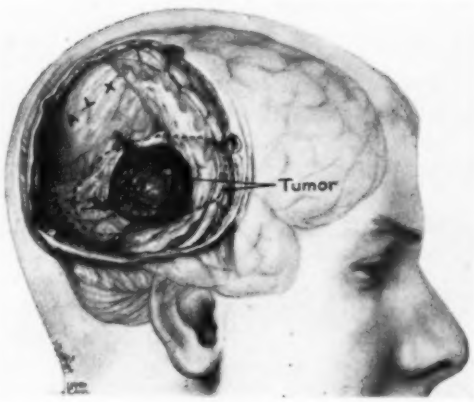

Fig. 7. Approach for large pineal tumor, necessitating resection of one occipital lobe to obtain adequate exposure. (From Horrax: Arch. Neurol. & Psychiat. **37:** 385–397, 1937.)

In this group of 12 there are 7 patients who are alive and well from two to fifteen years. Three of them have a moderate diabetes insipidus. One other patient had decompression and therapy only three months ago. Her pressure symptoms have not yet subsided. The remaining 4 patients died within a few days to a year after their operations.

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SUMARIO

El Diagnóstico y Tratamiento de los Tumores Pineales

Al tratar de determinar la presencia de un tumor pineal, revisten valor particular los hallazgos neurológicos, a saber, pérdida del movimiento conjugado de los globos oculares más arriba del plano horizontal y pérdida de la reacción de las pupilas a la luz en presencia de agudeza visual normal o cuasinormal. Estas características, presentes en un considerable porcentaje de los casos del A., se deben a la presión ejercida sobre los cuerpos cuadrigéminos y la subsecuente invasión de los núcleos del tercer y el cuarto par de nervios craneales. Otros hallazgos objetivos son los procedentes de la compresión cerebelar secundaria.

En la mayor parte de los casos el diagnóstico definitivo se establece por medio de la ventriculografía, que revelará dilatación de los ventrículos laterales y también de la porción anterior del tercer ventrículo. La porción posterior de este ventrículo muestra un nicho, por lo general en forma de una proyección redondeada, que representa el polo anterior del tumor.

Aunque el procedimiento de elección suele ser la completa extirpación quirúrgica, ciertos tumores responden temporal, y hasta permanentemente, a la roentgenoterapia, y en vista de los riesgos que encierra la operación, se recomienda un ensayo de dicho tratamiento, a menos que circunstancias críticas exijan una tentativa inmediata de extirpación. La irradiación debe ir precedida de la descompresión. Por lo general, se introduce, a través de dos puertas, una dosis total de 3,600 a 4,000 r (1,800 a 2,000 r al tumor).

De la serie del A., de 22 casos de tumor pineal, 12 fueron tratados por la simple descompresión o la biopsia seguidas de la roentgenoterapia; 7 han estado vivos y bien durante dos hasta quince años. De 10 sometidos a la extirpación quirúrgica macroscópicamente completa del tumor, 3 se hallan vivos al cabo de tres, cinco y diez años, respectivamente. En los 3 se administró la roentgenoterapia postoperatoria.

Roentgenologic Diagnosis of Pituitary Tumors[1]

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HERETOFORE THE roentgenologic diagnosis of pituitary tumors has been limited to those growths far enough advanced to cause the typical appearance which has come to be associated with sellar changes in this type of lesion. The diagnosis of early lesions has not been made, owing largely to the difficulty in distinguishing between the normal sella and the sella with borderline enlargement.

This problem has been complicated by the fact that on routine measurement 10 to 20 per cent of the acidophilic tumors do not show enlargement, and that the basophilic tumors thus far studied, with rare exceptions, have been microscopic in size. Changes in these latter cases are limited to the alterations of calcium architecture in the cranial vault. The chromophobe tumors, occurring more frequently than the others, have produced changes in all cases thus far diagnosed. In a number of cases of enlarged sella there has been no clinical evidence of the disease.

The problem has been further complicated by many borderline enlargements found on routine examination. It became apparent that we needed to make a careful review of our methods of measurement to determine whether an accurate study of the composites of the pituitary fossa and adjacent bony structures could be made on routine skull films.

Analysis of our routine procedure revealed (1) that it did not furnish a satisfactory method of measuring the size of the pituitary fossa, and (2) that measurements were limited to the size as seen in the lateral view.

In working out a satisfactory method of measurement of the sella we have been stimulated by Dr. L. M. Hurxthal, who has been particularly interested in determining the size of the pituitary fossa in the normal individual according to age, weight, and height, so that abnormalities in size might be demonstrated in certain glandular disturbances as well as in cases of pituitary tumor.

A more satisfactory technical method has also been devised whereby we are able to study the dorsal and anterior clinoids, the dorsum sellae, and the floor of the sella without detracting too much from the demonstration of other portions of the cranial vault. This has been done without increasing the number of films used in study of the skull. The roentgenograms are obtained with the patient in the upright position. A set of lateral and postero-anterior stereoscopic films is taken for routine study in the following manner.

For lateral stereoscopic views of the skull, in order not to show distortion of the floor of the sella, one film must be taken in the exact lateral position. To do this, the jaws must be superimposed and the central beam must be made to pass through the floor of the sella by directing the beam 2 cm. posterior to the outer canthus of the eye just above the zygomatic arch. The second film is taken with a cephalad shift of 3 1/2 inches with a 5-degree caudal tilt. The following factors are used: distance 42 inches, 120 ma. seconds, 58 to 60 kv.p., with a cone 5 inches in diameter.

In order that the anterior clinoids, posterior clinoids, dorsum sellae, and the floor of the sella may be demonstrated on the routine film, a considerable change in technic has been necessary in obtaining postero-anterior stereoscopic views. This routine has not previously been described in the literature, but we believe its use will

[1] Presented at the Thirty-third Annual Meeting of the Radiological Society of North America, Boston, Mass., Nov. 30–Dec. 5, 1947.

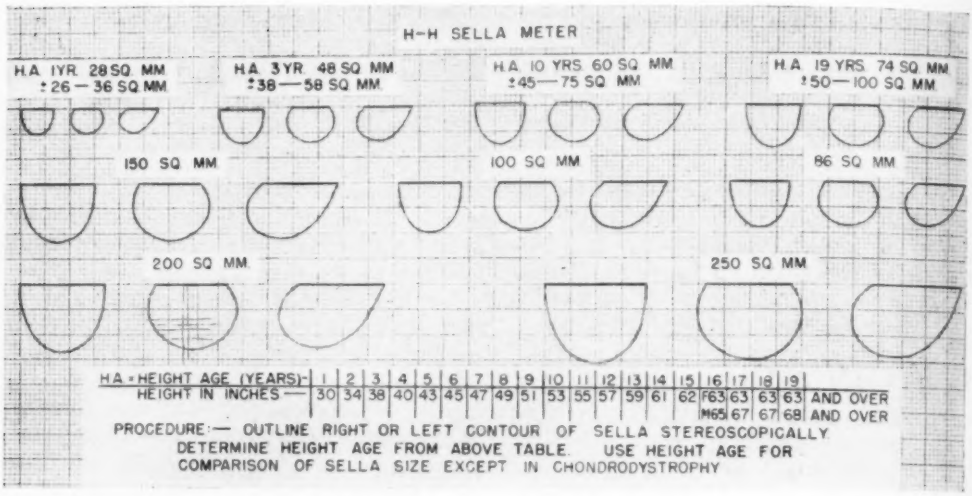

H-H SELLA METER
H.A. 1YR. 28 SQ. MM. ±26—36 SQ. MM.
H.A. 3 YR. 48 SQ. MM. ±38—58 SQ. MM.
H.A. 10 YRS. 60 SQ. MM. ±45—75 SQ. MM.
H.A. 19 YRS. 74 SQ. MM. ±50—100 SQ. MM.
150 SQ. MM.
100 SQ. MM.
86 SQ. MM.
200 SQ. MM.
250 SQ. MM.
H.A. = HEIGHT AGE (YEARS) 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
HEIGHT IN INCHES — 30 34 38 40 43 45 47 49 51 53 55 57 59 61 62 F63 M65 63 67 63 67 63 68 AND OVER
PROCEDURE:— OUTLINE RIGHT OR LEFT CONTOUR OF SELLA STEREOSCOPICALLY
DETERMINE HEIGHT AGE FROM ABOVE TABLE. USE HEIGHT AGE FOR
COMPARISON OF SELLA SIZE EXCEPT IN CHONDRODYSTROPHY

Fig. 1. Sella-meter.

provoke interest in the study of the region shown and will also verify the work done by Fariñas and published by him in 1939 (3). Fariñas' method of demonstrating the posterior clinoids and dorsum sellae by sagittal projections is an excellent one. The x-ray beam is directed through the cranial vault so as to show these regions in the foramen magnum in order that there will be no overlapping bony shadows to obscure them. We have not been successful in developing this method so that it may be used routinely, but in some cases in which a questionable lesion is shown on the routine film, it is a worthy addition.

The postero-anterior roentgenograms of the skull are taken in the upright position. The nose and forehead touch the upright Bucky, with the top of the cassette clearing the top of the skull by 2 inches. The central ray is directed through the skull 1/2 inch above the external auditory meatus for the first film. On the second film, the tube is moved down 3 1/2 inches and angled 5 degrees cephalad. The following factors are used: distance 42 inches, cone 5 inches in diameter, 65 kv., 130 ma. seconds.

After several months of attempting to measure the sella in the lateral projection, we decided it would be more accurate to measure the median plane, since it was not possible in all cases to obtain an exact lateral stereoscopic film. Therefore, when an exact lateral projection is not obtained, the median projection is outlined by marking a point midway between the posterior clinoids and the two sides of the floor. The outline of the sella is then transferred to transparent millimeter paper, which allows us to measure the number of square millimeters and also the anteroposterior and superior-inferior diameters, as in the conventional method. To obtain the square millimeter contour, a line is first drawn from the tuberculum sellae downward, across the floor, and up to the tip of the posterior clinoids; a line is then drawn from the tuberculum sellae to the posterior clinoids, which is roughly the outline of the diaphragm of the normal sella.

Haas (4) in 1925, proposed the square millimeter measurement of the sella turcica in the lateral projection, as we have done. At that time, however, he did not state the method of taking the roentgenograms, so that it is likely that the distance used was shorter and therefore the distortion more marked than on the present films. The size of the sella in the adult according to Haas was 85 sq. mm.

Heublein (5) measured 100 normal sellae

with variants and found the average anteroposterior diameter to be 10.66 mm. and the average depth 8.3 mm. The range was from 13 × 9 mm. to 8 × 5 mm. These figures correspond closely to an area of 70 to 80 sq. mm.

To quote from Pancoast, Pendergrass, and Schaeffer's *The Head and Neck in Roentgen Diagnosis* (8), "We found that the average normal adult and adolescent fossa varies from 8 to 9 mm. in depth and 9 to 10 mm. in the anteroposterior dimension. A depth of 10 mm. and an anteroposterior measurement of 11 to 12 mm. are considered top normal and in a patient with clinical evidence of an hypophyseal tumor may be even regarded as pathological."

We have measured the lateral projection of the sella turcica in approximately 700 cases, using both methods. At first this was a time-consuming and tedious procedure, until Hurxthal (6), after noting that most sellae developed in four or five different shapes, struck upon the idea of drawing the sella in shapes and sizes on the millimeter paper for various age, height, and weight groups, and then photographing these on transparent film, from then on called the sella-meter (Fig. 1). This has had to be revised and probably will call for further changes, but at present it offers a rapid and more accurate method of routine measurement than we have previously had.

Our studies agree with others as to the size of the normal sella, using conventional methods of measurement. The difficulty we have encountered and still have not determined to our satisfaction is how to classify those sellae which are larger than the normal and in which there is no clinical evidence of disease. The measurement of the lateral contour (for adults) in our series averaged 74 sq. mm. We have arbitrarily chosen 130 sq. mm. as denoting an enlarged sella, although we realize that in a few cases presenting definite abnormalities or disease the sella may be smaller and, conversely, that in those cases in which the sella is larger than 130 sq. mm., the patient may show no clinical evidence of disease at examination, but we believe a follow-up of these cases is desirable.

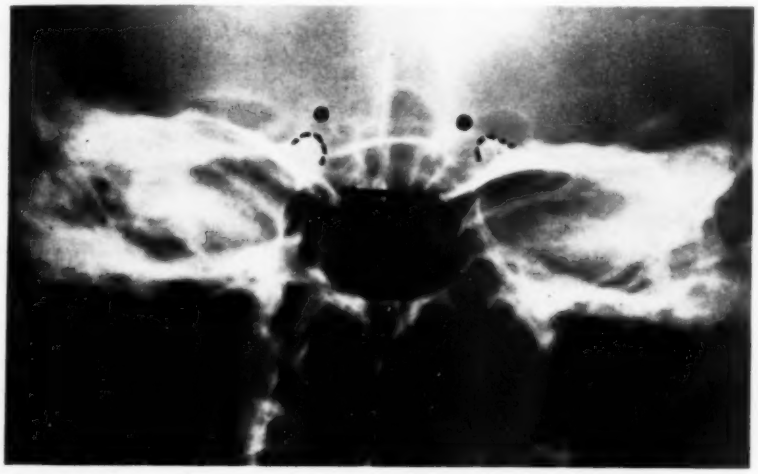
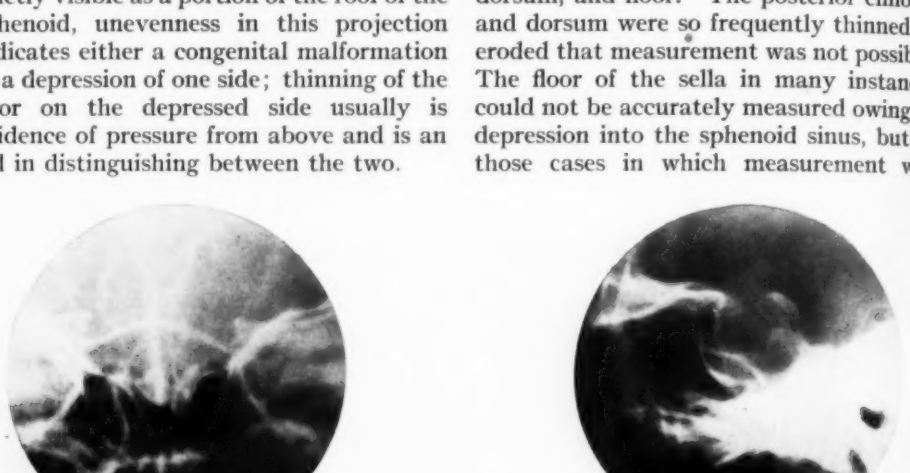


Fig. 2. Postero-anterior view. Posterior clinoids indicated by dots; anterior clinoids shown by dotted lines; floor of sella shown by unbroken line.

By using this method, we have demonstrated that the sella is larger than average in cretins, a finding which is confirmed by postmortem studies showing enlargement of the pituitary gland in this condition (1).

Frequently we have noted an uneven floor of the sella, in most instances, to be sure, because of rotation of the subject at the time of examination. In order to be

sure that there is no actual alteration of the floor, one should study it in the postero-anterior projection. Since in the postero-anterior stereoscopic film the floor is distinctly visible as a portion of the roof of the sphenoid, unevenness in this projection indicates either a congenital malformation or a depression of one side; thinning of the floor on the depressed side usually is evidence of pressure from above and is an aid in distinguishing between the two.



A B

Fig. 3. Postero-anterior (A) and lateral (B) views showing a well defined asymmetrical sella. The depression of the floor of the sella on the left is well shown on the postero-anterior projection.

In the postero-anterior projection (Fig. 2) we have found it possible to study and measure in the adult (to confirm the work of others) the distance between the anterior clinoids (average 2.6 cm.; upper range 2.8 cm.), the width of the posterior clinoids (average 18 mm.; range from 15 to 20 mm.), the width of the dorsum sellae (measured just below the posterior clinoids, 15 mm.; range from 9 to 18 mm.), and the width of the floor of the sella turcica (average 15.3 mm.; range from 9 to 23 mm.).

Following this study of the normal fossa and adjoining structures, we have reviewed the changes produced by tumors of the pituitary gland in 32 cases, most of which were pathologically unverified, though clinically the patients had definite visual field defects, loss of libido, amenorrhea, or acromegaly. In these cases the interclinoid distance averaged 26.8 mm., with a range from 21 to 32 mm. Sharpening and thinning of the anterior clinoids were present in 9 cases, but in only 2 was there erosion. In these 2 cases there was almost complete erosion of the dorsal clinoids, dorsum, and floor. The posterior clinoids and dorsum were so frequently thinned or eroded that measurement was not possible. The floor of the sella in many instances could not be accurately measured owing to depression into the sphenoid sinus, but in those cases in which measurement was possible, the average floor width was 20 mm., with a range from 16 to 28 mm. In 9 cases of this group, the floor was asymmetrical, and in a few cases in which asymmetry was not marked and enlargement was questionable, the postero-anterior view gave evidence of pressure changes and depression on the affected side (Fig. 3).

In this study there were 33 patients referred from the Department of Medicine between June 1946 and July 1947 with a lateral contour measurement of over 130 sq. mm. In only 5 of these cases was there clinical or histologic verification of a pituitary adenoma, thus showing that if tumors were present to cause the enlargement they could not be so diagnosed clinically or that some other condition was present to produce the change. In the other cases showing enlargement there was no significant clue as to the reason, but a follow-up may be significant.

The incidence of pituitary adenoma is

high according to Costello (2), who reported on the histologic changes of 1,000 pituitary glands examined postmortem. In 225—that is, nearly a fourth of those studied—there was one or more adenoma; 52.8 per cent were chromophobes; 7.5 per cent eosinophils; and 27.2 per cent basophils. The highest age incidence was in the sixth decade, but the range of occurrence was from 2 to 86 years. The tumors were of equal frequency in the sexes.

It is likely, therefore, that pituitary tumors occur more frequently than they are diagnosed either clinically or roentgenographically, and with evidence of enlargement of the sella on the roentgenogram, we have ample reason to follow the patient's course.

Aneurysm of the internal carotid artery may produce changes indistinguishable from pituitary adenoma. This is a rare finding and in those cases in which the clinical finding suggests aneurysm, arteriograms are necessary.

In 6 cases, not all in this series, the clinician ventured the opinion that the enlargement might be a result of prolonged estrogenic therapy, or that the onset of visual changes might have been hastened by large doses of estrogens. Definite tumors of the hypophysis have been produced in rats by administration of estrogens (7, 9). Zondek (10) reported enlargement of the hypophysis observed at autopsy in a patient dying of advanced carcinoma following administration of 6,000,000 international units of estradiol benzoate in sixty days. We should expect to see an increasing number of such cases if enlargement does occur from this cause, since estrogens are now being given in such high dosage.

Thinning of any portion of the sella in the presence of enlargement is good evidence of tumor, but this diagnosis is not excluded by absence of thinning, as the tumor may extend upward by breaking through or stretching its meningeal coverings.

SUMMARY

The purpose of this study has been to evaluate the methods of examining the sella turcica in normal individuals, and to determine the normal measurements. We have arbitrarily chosen 130 sq. mm. as the upper limit of normal for the lateral contour.

A roentgenologic technic is outlined which demonstrates the floor of the sella, the posterior clinoids, the dorsum sellae, and the anterior clinoids.

A rapid and accurate method of measuring the size of the pituitary fossa in the lateral projection has been presented.

The early changes produced by pituitary adenoma are discussed; however, there are still a number of individuals with enlargement of the sella turcica in whom no clinical disease has been demonstrated.

All of our cases of chromophobe pituitary adenomas clinically and histologically verified have shown enlargement of the sella turcica.

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(For Spanish Summary and Discussion, see following page)

SUMARIO

Diagnóstico Roentgenológico de los Tumores Hipofisarios

La técnica roentgenológica aquí bosquejada pone de manifiesto el piso de la silla turca, las apófisis clinoides anteriores y posteriores y el dorso de la silla. Se toma una radiografía en la posición lateral exacta, con las mandíbulas sobrepuestas y el haz central de rayos asestado 2 cm. detrás del ángulo palpebral, precisamente más arriba del arco cigomático, en tanto que la segunda radiografía se toma con una desviación de 9 cm. hacia la cabeza y una inclinación caudal de 5 grados. Las vistas postero-anteriores se obtienen en la posición erecta, asestando el rayo central a través del cráneo 29 cm. más arriba del meato auditivo externo, para la primera radiografía. Para la segunda se mueve el tubo 9 cm. hacia abajo y se inclina 5 grados hacia la cabeza.

Como no siempre puede obtenerse una película estereoscópica lateral exacta, se traza la proyección media marcando un punto a mitad de la distancia entre las clinoides posteriores y los dos lados del piso. Luego se traslada el contorno de la silla a papel milimétrico transparente, lo cual permite medir el número de milímetros cuadrados así como los diámetros antero-posteriores y supero-inferiores. Se simplifica la medición usando un "sillámetro," o sea un diagrama en papel milimétrico de las formas y tamaños de la silla turca para varios grupos de edades, tallas y pesos, fotografiado en película transparente.

Como límite máximo de lo normal se ha escogido arbitrariamente la cifra de 130 mm.^{2} para el contorno lateral. Treinta y tres enfermos con mediciones superiores a dicha cifra fueron examinados. En 5 de ellos había hallazgos clínicos o histológicos de adenoma hipofisario. Si bien la causa de la hipertrofia no era manifiesta en los otros casos, la observación subsecuente de los mismos puede revestir importancia, por paracer probable que los adenomas hipofisarios sean más frecuentes que su diagnóstico, ya clínico o radiológico.

Todos los casos de los AA., de adenoma hipofisario cromófobo comprobados revelaron hipertrofia de la silla turca.

DISCUSSION

(Papers by Horrax and by Hare, Silveus, and Smedal)

Joseph H. Marks (Boston): I have nothing to add to Dr. Horrax's account of pineal tumors. It has been my good fortune to work with Dr. Horrax and his associates during the past ten years and to have treated some of the patients included in this report. It is obvious that we have not yet solved the problem of the pineal tumor. X-ray therapy is apparently effective only when the predominant cell is of the pineal parenchyma. Extirpation is extremely difficult and has resulted in only a few survivals.

I believe that Dr. Hare and his associates have made a further contribution to our knowledge of the pituitary tumors, especially the chromophobe adenoma. Our former standards of diagnosis of such tumors included (1) obvious enlargement of the sella, but without a properly established limit of normal size,(2) decalcification of the walls of the sella, (3) sharpening of the anterior clinoids, and (4) thinning of the posterior clinoids, which showed a tendency to be concave forward. These criteria are undoubtedly the signs of a tumor of appreciable size and of months or years duration. They were usually accompanied by clear-cut clinical evidence of hypopituitarism and a bitemporal hemianopsia. It seems to me entirely possible that a more accurate set of normal measurements may make it possible for us to diagnose abnormality in an earlier stage.

I should think that we might look forward to further reports from Dr. Hare along two lines. (1) Have tumors become manifest in patients in whom an earlier examination showed slight enlargement but no changes in the clinoids? (2) What about the sella which seems to be definitely smaller than the average normal? Is this evidence of some primary hypopituitarism?

Roentgen Treatment of Bronchial Asthma[1]

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WE REALIZE THAT statistical studies of the results of the roentgen treatment of asthma are of only questionable value and that they may be misleading because of the multiple etiologic factors. We admit, also, that almost any kind of treatment, even a minor change in the usual medication or the use of a new proprietary remedy, may be effective in a certain number of patients. In the cases which we shall consider, roentgen therapy was used only after specific or non-specific therapy had failed to produce relief or after a specific cause for the asthmatic attacks could not be found. Most of our cases belong to the latter group. Some of the patients were known to be sensitive but failed to obtain relief by specific treatment. It has been our practice to employ some type of treatment other than roentgen therapy in almost all cases of asthma, but in a few instances irradiation has been used alone. No mild cases of asthma were treated with roentgen rays. About half of the patients had severe or very severe asthma; in the remainder the condition was moderately severe. The two groups constitute about 6 per cent of the total number of asthmatic patients who have been treated at the Mayo Clinic.

The use of roentgen rays in the treatment of asthma is by no means new. Most investigators have reported beneficial effects from such treatment. Various regions of the body have been irradiated, as the spleen, suprarenal glands, liver, thorax, long bones, and pituitary body, all with comparable results. In fact, some writers have "treated" patients without the roentgen tube being in operation at all and have obtained benefit.

In 1936, we reported (1) the results obtained by irradiation of the mediastinum in 23 cases of severe asthma. The patients were treated in the years 1931 to 1934, inclusive. Five of them were improved to a great degree for many months; 8 were definitely relieved for shorter periods. In the 10 remaining cases, the results were classified as failures. In this group of cases, a technic of treatment through paravertebral fields was favored, and a dose of about 550 r was administered in two days. Roentgen rays generated at 135 kv. and filtered through 6 mm. of aluminum were employed. The conceptions on which this treatment was based were as empiric and as indefinite as was our knowledge of the true nature of asthma, but in general the method seemed to produce better results than other methods which we had been using, such as irradiation of the spleen, of an anterior mediastinal field, or of a combination of different fields. The technic had the additional advantage of producing fewer gastro-intestinal upsets than did the methods previously employed, and, as we have said, it seemed to produce an appreciable relief from the asthma.

In 1939, we reported (2) another series of 215 cases treated in the years 1935 to 1937, inclusive. One hundred and sixty-one of these cases were available for statistical analysis. Thirty-eight (24 per cent) of the 161 patients obtained more than 75 per cent relief, lasting from one to many months. An additional group of 23 patients (14 per cent) obtained as much re-

[1] Presented at the Thirty-third Annual Meeting of the Radiological Society of North America, Boston, Mass., Nov. 30–Dec. 5, 1947.

lief but were not included in the former group because other treatment, given at the same time, may have been a factor in relieving the symptoms. Seventy-four patients (46 per cent) obtained less than 50 per cent relief or were relieved for only a very short period, and the results were considered failures.

The 215 patients were treated through a large anterior and a large posterior field over the mediastinum. This technic, which has been termed the "high-dosage" technic, was thought perhaps to produce better distribution of the radiation within the thorax and, therefore, to bring about better results. As in the first series, the roentgen rays were usually generated at 135 kv. and, as a rule, were filtered through 6 mm. of aluminum. A dose of 500 r, measured in air, was given to each field. Only rarely was the liver or spleen treated alone or in conjunction with treatment of the mediastinum.

In another small group of cases of asthma, one anterior field and two paravertebral fields were treated. Irradiation of the fields was given at an angle of 120 degrees. The results in this series were not satisfactory.

In the second study, we stated that we were unable to determine any criterion by which we could judge which patients would be relieved by roentgen treatment and which would not, but our impression was that the more severe or more constant the asthmatic symptoms the better was the chance that relief would be obtained. At that time we had no conclusive data by which we could explain the beneficial effect of roentgen rays in cases of asthma but we offered the theories that irradiation might decrease the secretory power of the mucous glands in the trachea, or might liberate antibodies from the leukocytes and that these might stimulate the production of eosinophils, or that the benefit might be due to an analgesic effect of the rays on the nervous system.

Incidentally, it might be mentioned here that, for a short time, we held the hypothesis that the effect of roentgen rays was due to the production of "protein shock" and that those patients who were most nauseated after treatment obtained the most relief. We therefore irradiated hypogastric fields in some cases and splenic fields in others. The nausea produced by this method and the failure of relief to ensue forced abandonment of this idea after a brief experience.

In 1943, there appeared reports of two other studies of the results of the roentgen treatment of asthma in an appreciable number of cases. As far as we have been able to determine, these are the only reports on this subject which have appeared in the roentgenologic literature to date.

Hull, Balyeat, and Chont (3) reported a series of 100 consecutive cases of chronic asthma treated with roentgen rays. They found roentgen therapy to be of definite value in those cases in which infection was present in the bronchial tubes, the paranasal sinuses, or at both sites, but to have little or no effect in cases in which infection was not present. These authors used a "cross-fire" method of irradiation in which the rays are concentrated over the greatest area of the lungs, where most of the bronchial tree is distributed. They were emphatic in stating that large areas should be treated for best results. In the average case, a total dose of from 800 to 1,600 r was administered in doses of 100 r at a time to six portals. In cases of severe asthma in which infection was present or the amount of purulent or mucoid secretion was considerable, the dose was increased above that given to the average patient. In cases in which the symptoms were mild, and in children, the dose given was considerably less than the average.

These patients had been followed for a period of eighteen months and during the first year from one to three courses of radiation therapy had been given. Fifty patients received one course, 35 patients two courses, and 15 patients three courses of treatment.

In this series of 100 cases, results were classified as follows: excellent in 39 per cent, good in 40 per cent, fair in 13 per

cent, poor in 6 per cent, failure in 2 per cent. The authors added that "it is, of course, not fair to say that the good results were obtained because the patients received radiation therapy, as they also received regular treatment consisting of desensitization where indicated, removal of offending foods, careful attention to environmental factors, etc."

Hull and his associates, discussing the possible danger of irradiation, said that excessive treatment may produce pulmonary fibrosis. In their experience, however, with the treatment of 100 patients in a period of six months, the authors had no reason to believe that pulmonary fibrosis had been produced, as they felt certain that the doses which they used were within the range of safety. The second danger they mentioned was that of producing roentgen burns of the skin. The amount of radiation which they used, however, they believed could be repeated safely each year for a period of eight to ten years.

Kaplan and Rubenfeld (4) had the opportunity of treating 95 asthmatic patients in Bellevue Hospital. Sixty-six of the 95 cases were available for analysis. In all the cases, the asthma was chronic and severe. Some of the patients had other diseases, as sinusitis, pneumonia, tonsillitis, and bronchitis.

All patients were treated with the same technic of irradiation. The roentgen rays were delivered at a potential of 200 kv., with 5 to 20 ma. of current, a 40 to 50 cm. target-skin distance, and filtration through 0.5 mm. of copper plus 1.0 mm. of aluminum. With unit doses of 100 to 150 r, measured in air, treatments were given twice or three times weekly until a dose of 600 r was administered. The usual procedure was to irradiate the thorax with an open field at a distance of 40 or 50 cm. and to alternate anteriorly and posteriorly until each side received 600 r.

Some modifications were used to control the spasms. Thus, 6 patients received 1,200 r rather than 600 r. Several received from 700 to 1,000 r, and one patient received 1,800 r.

Fifty-six patients received irradiation over the thorax. Of these, 36 were relieved of their spasms at the end of one series of treatment with a total dose of 600 r. In 8 cases, a total dose of 700 to 1,800 r was required. In 5 other cases, relief was only mild. No improvement at all was observed in 9 cases. The 13 patients who were irradiated over the cervical sympathetic chain obtained little or no relief. Splenic irradiation produced complete relief of the paroxysms in 4 cases.

A second series of treatments was given after recurrence of the asthmatic attacks. Irradiation of the thorax produced relief in 4 of 16 cases, and irradiation of the cervical sympathetic chain relieved the symptoms in 1 of 3 cases.

In an analysis of the results, the authors say that the symptoms were controlled in 48 (72.7 per cent) of the cases and partially controlled in 5 (7.5 per cent). No relief was obtained in 13 (19.7 per cent).

Kaplan and Rubenfeld gained the impression that the more severe and the more chronic the disease the better was the result to be expected. In their cases, aggravation of symptoms often preceded amelioration. Relief might ensue within hours after treatment had been administered. After a brief review of the technics of irradiation in the literature, as well as the theories which had been advanced to explain the effect of roentgen therapy in cases of asthma, these authors said that they had no new or favorite theory to offer.

Miller (5), in discussing Kaplan and Rubenfeld's paper stated that "we have observed between 60 to 70 patients who have been treated by roentgen therapy." He gave no further information about the treatment but he did say that good results had been obtained in some cases. He expressed the opinion that roentgen therapy probably could be used as an adjunct in the treatment of intrinsic, so-called bacterial asthma.

Shortly after our second paper on the roentgen treatment of severe asthma was prepared, we treated several patients who had exceptionally severe asthma and were

in precarious physical condition. Because we thought that the usual technic of treatment entailed an excessive risk, we halved the dose usually employed. In all of the cases in which the patients were treated in this manner, the results were satisfactory. This experience led us to adopt the application of a dose of about 250 r to one large anterior and one large posterior mediastinal field. We have now used this method of treatment, which has been termed the "low-dosage" technic, in more than 1,000 cases.

Up to the present time we have been unable to establish any criterion by which we can judge which patients will be relieved by roentgen treatment and which will not, but we still have the distinct impression that the more severe and the more constant the asthmatic attacks the better is the chance of obtaining relief with roentgen therapy. The age and sex of the patient and the duration of the current attack seem to make little difference. About 70 per cent of our patients were middle-aged women who had had asthma for many months (some patients had had the disease for twenty years or more). In general, the longer the duration of the disease the better is the outlook after roentgen treatment. This generalization, however, is subject to great reservation and numerous exceptions.

A group of cases in which the results of roentgen therapy were unsatisfactory was compared with a group of cases in which the results were satisfactory, in an attempt to ascertain whether such factors as anemia, leukocytosis, eosinophilia, fever, sputum, hay fever, bronchitis, emphysema, bronchiectasis, nasal polyposis, sinusitis, and drug allergy might play a role in the outcome, but the results of this comparison were too indefinite to allow any deductions.

TECHNIC OF LOW-DOSAGE ROENTGEN THERAPY

In the low-dosage technic, which we are using at present, a large field (16 cm. square) is centered on approximately the center of the sternum, and a posterior field is arranged at a corresponding level. By this layout of fields, not only the hilar lymph nodes but also a considerable amount of adjacent pulmonary tissue is irradiated. We are certain that the use of large fields produces better results than does the use of narrow fields through which only the hilar region is irradiated. Each field receives a dose of 256 r, measured in air. The roentgen rays are generated at 130 kv. and are filtered through 5 mm. of aluminum. As a rule, the treatment is completed in two consecutive days.

We have, on rare occasions, treated both fields in one day. The single advantage of doing this is that it saves a day; this, however, is not the whole story for, as a rule, the nausea and vomiting, which are very likely to follow, penalize the patient for the day he may have saved. Since we think that the asthmatic symptoms are more likely to be aggravated when irradiation is completed in one day than they are when it is given in two days, we do not advise the single treatment unless the patient has been fully warned of the likelihood of complications.

RESULTS OF LOW-DOSAGE ROENTGEN THERAPY

With the exception of mild nausea, which occurred in about a tenth of the cases in which low-dosage irradiation was used, disagreeable effects have been rarely encountered. We are certain that the incidence of all untoward reactions has been far less than with the other technics we have used.

Some improvement in the asthma is usually noticed within a day or two, but the full effect is not obtained, as a rule, for four to five days after the completion of treatment. In a few cases benefit may be delayed for a week or ten days or more. In these cases, the benefit may be due, perhaps, to factors other than roentgen therapy. In another small group of cases the improvement may slowly increase over a period of a few weeks, but, as we have said, this is an exceptional occurrence.

As far as we know, there is no parallelism between the promptness of the onset of the improvement and either its degree or its duration. In many cases improvement has begun within a week after the completion of treatment and the patients have remained entirely free from asthmatic attacks for many months. In an equal number of cases, a relapse has occurred in a few weeks. In most instances in which relief has been obtained, subsequent treatment also has produced relief, but disappointments are not uncommon. A patient may obtain remarkable relief after the first course of treatment, but subsequent treatments may be without effect. In another case the first course may be unsuccessful, but the patient may obtain relief after the second course, none after the third and fourth courses, but long-lasting relief after the fifth course. Other patients obtain satisfactory relief after all treatments and may return to the clinic for the express purpose of receiving only roentgen treatment.

We have no good reason for advocating roentgen therapy as a prophylactic or as a precautionary measure to forestall asthmatic attacks in cases in which relief has occurred. As a rule, we prefer to postpone repetition of treatment as long as the relief lasts. We have had no experienee with the frequent application of roentgen rays until relief is obtained, although others report satisfactory results with this method of treatment.

With the doses of roentgen rays which we have used, there is no risk whatever of injuring the skin or the thoracic structures. We can accept no excuse for substituting any injury for a relatively benign condition such as asthma; however, it should be most emphatically stated that if treatments are applied too frequently they can do a great deal of harm. Incidentally, one woman has had twelve treatments in a period of three years without the slightest evidence of any roentgen injury. Future treatments in her case will necessitate the greatest caution.

TABLE I: COMPARISON OF RESULTS OF LOW-DOSAGE AND HIGH-DOSAGE ROENTGEN THERAPY IN ASTHMA

Result	Cases Treated with Low-dosage Technic	Cases Treated with High-dosage Technic
Failure	9	24
Fair	21	11
Good	53	43
Complete relief	11	8
Doubtful	6	14
TOTAL	100	100

Table I shows the results of low-dosage and high-dosage roentgen therapy in two series of cases which were taken at random. We cannot explain the reason for the superior results of low-dosage roentgen therapy, and it seems pointless to add more hypothetical conceptions to the already complicated subject, the treatment of asthma.

Our experience in the treatment of asthma with roentgen rays has been similar in all essentials to our experience in the treatment of inflammatory and infectious lesions, in which our results have improved as the doses of roentgen rays have been lowered. For this reason, we think that a lower dose, possibly in the neighborhood of 100 r, or even less, may be worth a trial in another series of cases of chronic, severe, intractable asthma.

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(For Spanish summary, see following page)

SUMARIO

Roentgenoterapia del Asma Bronquial

Los AA. han reemplazado su antigua técnica de dosis altas (500 r al aire a cada uno de dos campos mediastínicos) para aliviar el asma (vease J. Allergy **10:** 135, 1939) con otra de dosis bajas, que ha mejorado sus resultados. El tratamiento es administrado a través de un campo grande (16 × 16 cm.) sobre el centro del esternón y un campo posterior a la misma altura, de modo que se irradian no sólo los ganglios hiliares sino también una considerable porción del tejido pulmonar adyacente. Cada campo recibe un total de 250 r, administrados de preferencia en dos días consecutivos. Esa técnica ha sido usada en más de 1,000 casos sin efectos contraproducentes, aparte de leves náuseas en 10 por ciento aproximadamente de los enfermos. La mejoría suele manifestarse en uno o dos días, pero por lo regular no se obtiene el pleno efecto sino a los cuatro o cinco días de la irradiación.

En los casos en que se obtiene alivio, el tratamiento subsiguiente también ha producido habitualmente, pero no invariablemente, alivio. Un enfermo ha recibido doce tratamientos durante un período de tres años, pero se recalca que la repetición demasiado frecuente puede ocasionar daño grave. En 100 casos tomados al azar, obtúvose alivio completo en 11; el resultado fué bueno en 53 y mediano en 21; hubo 9 fracasos; en 6 el efecto parece dudoso.

Radiation Necrosis of the Jaw[1]

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ANY RADIOLOGIST who treats cancer about the mouth and face is certain to see an occasional case of necrosis of the jaw. The more energetic the treatment, the greater the chance of cure of the cancer and the greater the likelihood of damage to the jaw. The purpose of this discussion is to point out certain methods of avoiding this complication, how to deal with the necrosis once it has taken place, and how to repair the defect thus created.

Devitalized teeth lead to sepsis. Teeth subjected to irradiation show receding of the surrounding mucosa; the blood supply is impaired, and pyorrhea and sepsis follow. Sepsis creates havoc in irradiated tissues. Therefore, teeth and irradiation therapy are not compatible.

Whenever deep x-ray therapy is to be directed to lesions of the mouth, any teeth through which the beam will pass should be removed before treatment is started. This is not necessary when irradiating the tonsil, but is quite essential in treating the tongue through a lateral portal, the buccal mucosa, alveolar ridges, and floor of the mouth. In some instances extractions on one side are sufficient. If all the teeth are devitalized or carious, it is better to extract them all. It is our policy to defer treatment for one week after the extractions. During this time, penicillin is given orally and thorough mouth irrigation is carried out. Objection is sometimes made to the delay in treatment thus entailed, but we are convinced that it is time well spent. Once treatment has been given, we feel certain that none of the teeth exposed to irradiation should be extracted for a period of several years. So the edict is that the teeth, no matter how healthy, come out before treatment and not afterward. We have had this impressed on us time and time again. There are no exceptions.

Following irradiation, also, there is need of careful mouth hygiene. Mouth washes, irrigations, and penicillin lozenges, as well as adequate liquid, food, and vitamin intake, are important. At any subsequent date, infection in or adjacent to the irradiated area should be dealt with vigorously.

The first evidence that something is wrong is usually a complaint from the patient that he has pain. Inspection will show a devitalized area of mucosa or periosteum, and a little later bare bone will appear. This exposed bone is sick bone but it is not yet dead. It will not act like the usual bone infection from an abscessed tooth, osteomyelitis, or a compound fracture. It will not form a spontaneous sequestrum, but it will never cover over with periosteum or mucosa. If one realizes these facts and acts promptly, much time and suffering will be saved. If the exposed bone is treated by electrocoagulation (1), it will die and separate as a heat sequestrum, with some chance that the deeper bone will cover over. The fact that an electric current will pass through irradiated bone indicates that the latter has some viability.

Exposure of bone leads to infection which travels slowly but surely into the bone and around it. The first indication of extensive infection may be the appearance of cellulitis in the face or neck. Infection in the irradiated field causes the soft parts to break down and a fistula develops. The infection travels up and down the surface of the bone until the whole jaw is separated from the periosteum. There is never any regeneration.

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[1] From the Pondville Hospital (Massachusetts Department of Public Health), P. O., Walpole, Mass., and the Tumor Clinic of the Massachusetts General Hospital, Boston. Pondville Reprint, No. 125. Presented at the Thirty-third Annual Meeting of the Radiological Society of North America, Boston, Mass., Nov. 30–Dec. 5, 1947.

We have repeatedly seen large segments of bone exposed and even the entire jaw stripped of periosteum, and yet this could not be detected on x-ray films. Direct vision will give more information than roentgenography.

Prompt action is advised, for it may avoid a fistula. Electrocoagulation of the exposed bone or removal of surface bone with rongeurs may save the day. Otherwise, if the condition is advanced, all bone devoid of periosteum must be removed. The end of the remaining bone, if it is live bone, will flake off as sequestra, and healing will occur. When the whole jaw is destroyed, it may be removed easily by dividing it with a Gigli saw, after which the two segments can be slipped out. The attachments of the muscles and capsule around the temporomandibular joint and the coronoid process may have to be divided to allow the upper fragment to be removed.

Mention has been made of the danger of sepsis introduced into irradiated areas through defective teeth. The writer has previously reported a case (2) in which infection from the jaw caused a large temporal abscess, with subsequent invasion and destruction of the irradiated area in the cheek.

Any soft tissues that have been subjected to heavy irradiation show fibrosis and damaged blood supply. If a growth is not destroyed by the treatment, it continues to grow and to invade. Hemorrhage may be a real problem. The first inclination is to ligate the bleeding vessel either in the wound or at its source. This is a dangerous procedure. To ligate, for instance, the external carotid artery for hemorrhage from an irradiated mouth will mean cutting off blood supply which is needed to keep the tissue viable. We have reported (2) a case in which ligation of the external carotid resulted in complete destruction of the entire rectangular field of treatment. However, such a ligation should be performed for hemorrhage if the patient has a good chance of cure of his cancer, for repair of the defect is possible.

It is not the purpose of this paper to frighten radiologists into not treating mouth cancer. It is my belief that small carcinomas of the buccal mucosa, tongue, and alveolus should be treated surgically, but there is still a large field for radiology. The purpose of treatment is to destroy cancer even though other tissues may be damaged, and therapy should be given to the limit if there are prospects of cure. If, however, there are distant metastases or if there are fixed metastatic cervical nodes and cure is impossible, therapy should not be pushed to the limit. Only enough treatment should be given to produce palliation.

Where does the surgeon fit into the picture? Personally, I believe that he should treat the early lesions of the tongue, buccal mucosa, and alveolar ridge, either by excision or by electrocoagulation. He should do radical node dissections on all patients whose primary lesions are controlled. Whenever necrosis of bone appears, the surgeon should take over. It will be his province to carry on reconstruction after the radiologist has destroyed the cancer. Finally, in a certain number of cases in which the radiologist has failed to effect a cure there is still a chance of cure by radical surgery.

Certain case records have been selected to teach certain lessons and to save more lives. In the first case, would a variation in technic have avoided necrosis?

CASE 1: F. W. M., a man of 56, was first examined on July 30, 1942. A lesion 2 × 2 cm. in the left side of his mouth, involving the posterior buccal mucosa and anterior pillar, had recently been discovered by his dentist. There was no involvement of the jaw and there were no palpable lymph nodes in the neck. Through an error, no biopsy was done at this time.

The patient was referred to a competent radiologist, who gave him 6,000 r intraorally (200 kv., 20 ma., 35 cm. distance, 0.5 mm. copper and 1.0 mm. aluminum filter, 3.8 × 3.8-cm. portal, 300 r daily) and 2,750 r externally (50 cm., 200 r per day), over an elapsed period of twenty-two days. There was prompt response to the therapy and when I next saw the patient, on Feb. 24, 1943, the lesion had disappeared and was replaced by a depressed scar. At this time a hard lymph node, 2 × 2 cm., was

palpable over the internal jugular vein. It was felt that this was a malignant node, and a radical neck dissection was advised.

Operation was performed on March 4, 1943, at the Phillips House of the Massachusetts General Hospital. A radical neck dissection was carried out under gas-oxygen-ether intratracheal anesthesia. The platysma muscle, sternocleidomastoid muscle, the internal jugular vein, the submaxillary salivary gland, and all the fat and lymphoid tissue from the clavicle to the trapezius muscle and up to the jaw and mastoid region were removed. The eleventh nerve was sacrificed. An old branchial sinus was dissected out; this extended from the lower portion of the sternocleidomastoid muscle along the inner aspect of the platysma muscle, beneath the digastric muscle, behind the hyoglossus muscle, and then spread out near the lateral pharynx.

The report of the pathologist was "metastatic epidermoid carcinoma in one of fourteen lymph nodes." No grade was mentioned. (A positive report on this node possibly balances the sin of not getting an original biopsy.) Recovery from the operation was good.

Six weeks later, April 28, a small area of ulceration in the radiation scar on the anterior pillar was discovered. This did not look like a recurrence and it healed promptly. It was thought possible that the area had been traumatized during the intratracheal anesthesia.

In December 1944, more than two years after x-ray therapy, an area of ulceration appeared on the alveolar ridge anterior to the malignant lesion. It was noted that this was in the path of the x-ray beam directed to the anterior pillar. The ulcer increased in size and depth until bare bone could be seen, but the patient had few symptoms during the next ten months. Edema of the face then developed, with an area of redness overlying the left lower jaw. Pus was seen between the jaw and the cheek, and it was decided that the whole thickness of the jaw was necrotic. There was also numbness over the entire course of the third division of the fifth nerve. X-ray films did not show any abnormality in the bone.

The patient was again admitted to the Phillips House, and on Nov. 2, 1945, the area of necrotic bone was removed through the mouth. A rim of normal bone was left on the posterior aspect of the jaw, but this was fractured during removal of some of the irradiated bone. The wound was left wide open. Penicillin was administered before and after operation and pain was relieved. Three weeks later an abscess formed in the neck, requiring drainage. Following this, a sinus appeared, and gradually the area of irradiated tissue became necrotic. On Jan. 15, 1946, following a course of penicillin therapy, the abscess cavity was enlarged and necrotic bone found. Rongeurs were used to remove all damaged bone proximal and distal to the sinus. The abscessed area was excised and the wound closed. Healing was complete in ten days. There was now a complete defect about 4 cm. long in the jaw, extending back to the angle. A few weeks later a small sequestrum was discharged from the wound, but for over a year the patient has been free of symptoms. There is a pinpoint sinus in the mouth down to bone at the angle of the jaw. The anterior end is healed over.

There has never been any recurrence of the cancer, and there have been no further metastases in the neck (four years, nine months).

Comment: It might be well to avoid tangential irradiation of normal bone. This man is apparently cured of both primary and metastatic cancer by a combination of surgery and irradiation.

Dental sepsis plays a definite role in the development of necrosis.

CASE 2: A. O., a man of 46, was admitted to the Pondville Hospital on March 18, 1937, with recurrent carcinoma of the lip. The recurrent nodule was small, but the examining physician stated: "In the submental triangle is a fixed mass of stony-hard recurrent disease extending under the left jaw and forming another fixed mass beneath the left angle. Any further surgery is out of the question and this becomes entirely a case for x-ray *palliation*." The patient received dental hygienic care but no extractions were performed. The original biopsy from the lip showed "epidermoid carcinoma, grade III." No biopsy was done on the metastatic nodes.

X-ray treatments were given to the lip, chin, submental, and submaxillary regions, at first as a palliative measure. The response was so good, however, that additional treatments were given up to a total of 2,600 r (200 kv., 20 ma., 50 cm. distance, 0.5 mm. copper). There was complete regression of the tumor at the end of two months.

In September, films of the jaw showed osteolytic changes. There had been good regression of the cancer, however, and there was no outward sign of recurrence. In November, two abscessed teeth within the field of irradiation were extracted. In January 1939, a definite area of osteonecrosis was evident, but there was little change in the patient's condition until the following November, when an acute inflammatory condition in the neck developed beneath the exposed bone. This subsided, but x-rays showed marked increase in density in a segment of the jaw, and operation was advised.

On Feb. 12, 1940, a partial resection of the jaw was performed, following which severe pulmonary complications occurred. A small fistula appeared in the neck and persisted for nearly three years, at the end of which time it closed spontaneously.

The patient still has considerable deformity of the face and jaw, but he has refused reconstructive surgery. He was last seen on July 31, 1947, when no recurrence could be found. This was over ten years after x-ray treatment for "palliation."

Fig. 1. Case 3. The jaw and cheek have been destroyed by radiation necrosis. The patient is ready for reconstruction. A dental prosthesis can be seen through the aperture.
Fig. 2A and B. Case 3. The face has been reconstructed

Comment: Frequently cases accepted for palliation turn out to be cures. Our radiologist's motto is "nothing attempted, nothing gained." However, violation of the rule for extractions before therapy caused no end of trouble.

CASE 3: J. J. Q., a man of 59, was admitted to the Pondville Hospital on March 7, 1940, with a lesion on the cheek, measuring 8 × 5 cm., portions of which were ulcerated. Pathologically, this was a basal-cell carcinoma, and x-ray treatment was advised. The patient was not examined by the dentist until his treatment was nearly completed, but it was noted that he had gingivitis and one partially buried root.

The therapy consisted of 4,500 r at 200 kv., delivered in six treatments through an 8-cm. cone at 20 mm. distance with 0.25 mm. copper filter. Following treatment, a very severe reaction developed on the cheek, buccal mucosa, and tongue. The patient returned home but had to be readmitted two months later because of pain, inability to eat or sleep, and a resulting severe malnutrition. On tube feedings, oral irrigations, and general nursing care, he made a slow recovery. Five months after treatment the primary lesion had disappeared, but there was still an area of ulceration on the buccal mucosa. This was being aggravated by an upper tooth which pressed into it. The tooth was extracted under general anesthesia.

In November (eight months after treatment) necrosis of the entire irradiated area took place, and a fistula developed through the cheek. The jaw became exposed and necrotic. It was divided under pentothal anesthesia and removed in two segments from the mid-line anteriorly to the temporomandibular joint.

One year after x-ray therapy the patient returned for plastic reconstruction (Fig. 1). He showed no evidence of recurrence of his cancer. A tube pedicle was prepared from the neck and chest wall in several stages and the defect was finally closed. Because of loss of part of the original flap, plans had to be changed and the repair was slow. It was completed, however, in about six months (Fig. 2).

The patient was able to return to work at the Navy Yard and to eat soft food. His only complaint was of hair growing on the inside of the flap. He died of bilateral lobar pneumonia at the Massachusetts General Hospital on Dec. 22, 1943. Autopsy revealed no persisting cancer.

Comment: One wonders whether too penetrating a dose of radiation were not given in this case. Certainly, if it were to be given, all teeth within the beam should have been removed before treatment, for they were a factor in the necrosis of the cheek which antedated necrosis of the jaw.

In the two following cases late extractions complicated recovery and started necrosis.

CASE 4: A. C. O., a woman of 50, was admitted to the Massachusetts General Hospital on May 28, 1937, with a carcinoma of the tongue discovered two weeks previously. Examination showed a lesion on

the right posterior tongue extending back as far as the finger would reach toward the base and to within 2 cm. of the tip. Two large soft nodes in the submaxillary region were thought to be inflammatory in nature. Biopsy of the tongue lesion was done and reported as grade I, epidermoid carcinoma. Deep x-ray therapy was advised. The patient was said to be edentulous.

Daily doses of 300 r were given through a 6 × 5 cm. portal to the cheek at the level of the mandible, for a total of 4,200 r (200 kv., 10 ma., 50 cm. distance, 0.5 mm. copper and 1.0 mm. aluminum filter) over a period of sixteen days, after which 1,800 r were given to the submandibular region over a period of six days. There was good regression, but because of evidence of active disease in August, the patient was given 1,000 r in two doses through a 4 × 5-cm. cone through the submaxillary region aimed at the right side of the mid tongue. In November, 2,000 r were given through an intraoral cone to the right side of the tongue.

Although on admission the statement was made that the patient's teeth were false, in December there is a note by a radiologist saying that "the incisors and left bicuspids are still present and show evidence of pyorrhea; *they should not be touched.*" The tongue lesion cleared up entirely. Under date of October 1938, is a note of pyorrhea and tenderness in the jaw. It was decided to extract the remaining teeth, one at first, then two, and finally three. Healing was satisfactory.

In December 1940, two and a half years after therapy and two years after the extractions, bare bone was discovered in the right bicuspid area. Six months later a small sequestrum came away and another a few months later, but still there remained much bare bone.

In December 1945, an infection over the jaw developed and a sinus formed down to the bone. Operation was carried out on Dec. 8. All of the exposed bone on the right lower jaw was removed by rongeurs. Following this, the fistula persisted until it was closed by a minor plastic operation in March 1947. The remainder of the jaw remains in good condition and there has been no recurrence of the carcinoma of the tongue up to June 1947 (ten years).

Comment: Apparently the teeth in the anterior jaw were damaged by therapy. From this case the practice has arisen to remove all the teeth on both sides of the lower jaw before starting irradiation.

CASE 5: M. F., a man of 52, was admitted to the Pondville Hospital on April 7, 1940, with cancer of the tongue. The lesion was 3 cm. in diameter and involved the right side of the dorsum anterior to the line of the vallate papillae and extending slightly across the mid-line. There was one hard palpable node in the neck. Biopsy showed epidermoid carcinoma, grade I.

Extraction of the patient's few remaining teeth was advised but was refused by him. He was given x-ray therapy, up to 5,200 r (200 kv., 20 ma., 27 cm. distance) through an intraoral cone and 3,900 r to a lateral 6 × 8-cm. portal at 50 cm. distance. Treatment was given at the rate of 300 r externally and 400 r intraorally daily, over an elapsed period of twenty-two days. No tumor could be seen or felt at the end of this period.

On Aug. 15, 1940, a firm node, 3 × 3 × 3.5 cm., was observed in the right jugular chain. Fifteen gold seeds, 2 cm. each, were implanted in this node under novocaine for a dose of 3,960 mc. hr. Though no biopsy was done, it seemed to be definitely cancerous. Our usual procedure for a node of this type would be removal by a radical neck dissection if it were felt that the primary lesion was controlled.

The patient remained free from recurrence and quite well until May 20, 1943, when he visited the hospital because of an abscessed right inferior second molar tooth. Extraction was postponed, but had to be performed one month later. Healing of the cavity was delayed because of the effect of the previous radiation. During the next year several other abscessed teeth were removed and each time severe sepsis developed in the neck. On March 30, 1944, a small area of ulceration in the irradiated area was noted, but this healed and the patient remained well until August 1947. At that time he complained of trismus, showed induration near the scar of irradiation, and had an abscess of the third molar tooth. During the next month the area of irradiation broke down completely and the underlying bone became exposed. X-rays showed an abscessed tooth but no recurrence.

On Nov. 24, 1947, operation was done under intratracheal anesthesia. The jaw was found to be stripped of periosteum from the third molar tooth up to the temporomandibular joint and there was a fistula from the mouth. The involved bone was removed and later a plastic closure will be carried out. There has been no recurrence of the cancer.

Comment: This destruction of the jaw and break-down of the irradiated wound seven years after the successful treatment of the cancer of the tongue can be explained only on the basis of sepsis from abscessed teeth. Had the patient accepted the advice of the clinic physicians and had all teeth on the side of involvement extracted before therapy was begun, the chances are that he would still have his jaw.

In the next case early surgical electrocoagulation was effective in halting the spread of necrosis.

CASE 6: J. J. L., a man of 63, was admitted to the Pondville Hospital on Feb. 5, 1939, with a lesion on

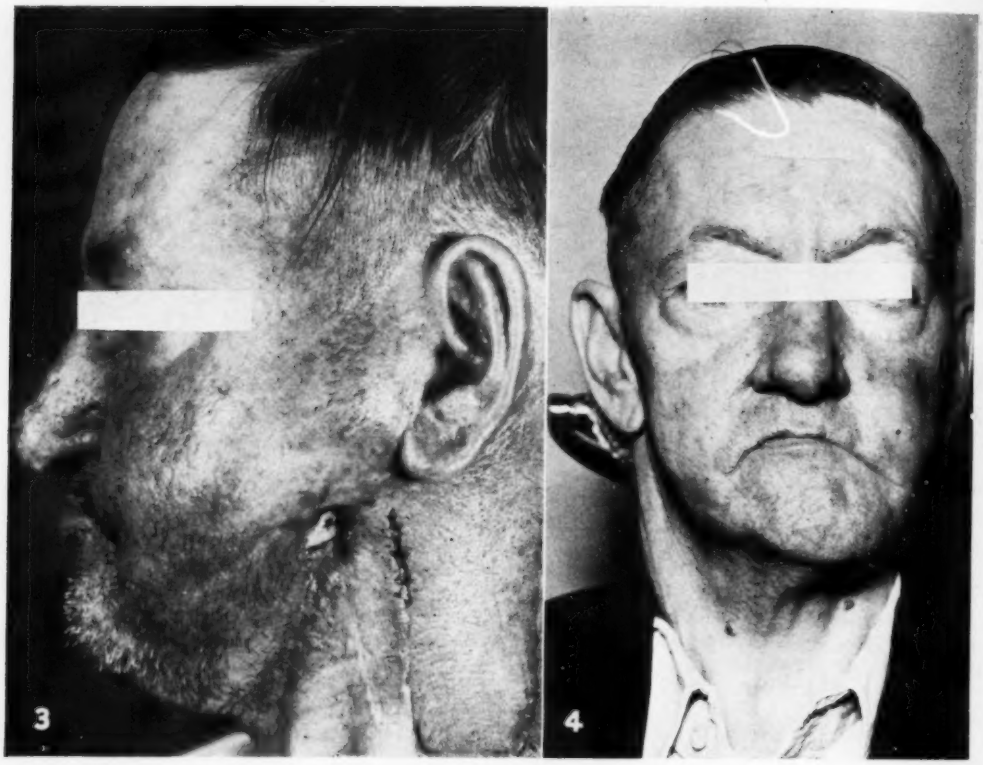

Fig. 3. Case 7. An area of bare bone is visible through the fistula.
Fig. 4. Case 7. Appearance after reconstruction.

the right posterior buccal mucosa, measuring 4 × 4 cm. It was ulcerated and indurated and immediately adjacent to the jaw, with no involvement of the bone. Biopsy showed epidermoid carcinoma. One node was palpable in the neck, but this did not seem to be malignant. The patient was very obese (weight 250 lb.). X-ray treatment was advised.

During the next three weeks thirty-one treatments were given: fourteen of 400 r each intraorally (200 kv., 20 ma., 50 cm. distance, 0.5 mm. copper filter) using a 3.5 × 4-cm. cone, and 17 treatments of 300 r each externally using a 6 × 8-cm. portal but at a distance of 30 cm. There was excellent regression of the disease, but the reaction was very severe.

In August 1939, five months after therapy, there was no sign of recurrence but a large area of induration was present in the neck. The condition remained stationary for the next nine months, but there was no sign of healing. In May 1940, the exposed bone was removed with rongeurs under pentothal anesthesia. There was no improvement and in July 1940 further operation was performed. The exposed portion of bone was again removed with rongeurs, and the underlying bone was then subjected to thorough electrocoagulation on its surface. A few months later the destroyed bone began to sequestrate. The final piece was discharged a year later, and the jaw then healed. There was never complete division of the jaw or any pathological fracture, and never any recurrence of the cancer.

Death, due to a cerebral hemorrhage, occurred on May 13, 1945, at the age of sixty-nine.

Comment: The thin periosteum overlying the jaw was very vulnerable to radiation. Once this was destroyed, necrosis of the jaw occurred. Heat coagulation of this bone finally allowed sequestration, followed by healing. It is probable that coagulation at an earlier date would have prevented many months of discomfort.

The next case is a straightforward one. There are no flaws in the therapy that we can see.

CASE 7: E. D., a man of 56, was admitted to the Baker Memorial of the Massachusetts General Hospital on May 9, 1946. In August 1944, he had

noticed a lesion on the posterior aspect of the left lower alveolar ridge. The first biopsy was unsatisfactory, but the lesion persisted. Two months later, after a series of consultations, a biopsy report of squamous-cell carcinoma, grade II, was obtained. At this time the lesion involved the floor of the mouth posteriorly and the alveolar ridge, and extended into the tongue. The radiologist who referred him described the treatment as follows:

"Between Oct. 11 and Nov. 10, 1944, the patient received a total of 4,200 r directed through a 6 × 8-cm. external portal. Three thousand roentgens were likewise cross-fired to the same area through an intraoral cone. The factors were 200 kv., 20 ma., 50 cm. distance, with 0.5 mm. copper, 300 r being administered daily. The course was uneventful, and by Dec. 8, 1944, there was no demonstrable evidence of disease within the mouth. Radiation reaction on the skin was subsiding, but still apparent. In January 1945, there was complete disappearance of the radiation reaction of the skin. By March 1945, the most anterior portion of the original site of disease showed an area of slough, which gradually increased in size as the bone of the alveolar ridge became exposed."

The area of necrosis was that which was originally covered by tumor although there probably was no invasion. However, destruction of the thin periosteum resulted in exposure of the bone.

The history goes on to state that, in April 1945, induration in the neck developed, followed by the formation of an abscess which required drainage. This was an indication that the infection which started in the exposed bone had encircled the bone to reach the neck. Films of the mandible at this time showed no erosion or sequestration but it has been shown repeatedly that the bone may be completely destroyed and this may not be evident on a film. In June, readmission was required for relief of pain, which was accomplished by neurosurgical measures.

From June on, the crater gradually broke through into the neck until all the irradiated area broke down and the mandible became exposed externally (Fig. 3). A fistula formed from the mouth. This was the condition when I saw the patient in April 1946. There was no evidence of recurrence.

On May 11, 1946, the first stage of operative treatment was carried out. This consisted in elevating a flap of skin behind the area of necrosis for later use in closing the defect. One week later an operation was performed on the jaw. The jaw was found to be denuded of periosteum and, therefore, dead from the midportion of the horizontal ramus up to the temporomandibular joint. There was one loose fragment at the angle. All of the exposed bone was removed and the division of the horizontal ramus was done in apparently normal bone. The pathologist reported that there was radiation necrosis but no persistent cancer.

Following this procedure the wound granulated rapidly. Three weeks later the mucous membrane was freed from the edges of the defect and it was closed from within the mouth. The flap previously elevated was rotated to close the external defect. Healing was complete in two weeks (Fig. 4).

Six months later a new lesion appeared in the floor of the mouth, beneath the tip of the tongue on the other side. This was excised by another surgeon. To date there has been no recurrence of the original cancer. The defect in the jaw gives little trouble.

In the last two cases radical surgery succeeded where roentgen therapy had failed. Fortunately, in neither of these patients did any lymph-node metastases develop.

CASE 8: S. M., a man of 68, was first examined in the Tumor Clinic of the Massachusetts General Hospital on June 26, 1942, with an extensive carcinoma of the left buccal mucosa with necrosis of his jaw. He had been given deep x-ray therapy at another hospital and was referred for the possibility of surgery. He had received 4,600 r at 220 kv. between Feb. 28 and May 15. The other factors are not known. There was persistent disease, with evidence of bone involvement. The patient was in great pain. Biopsy showed epidermoid carcinoma, grade III. There were no palpable nodes.

On July 22, 1942, wide resection was done of the entire diseased area back to the angle of the jaw and forward to the symphysis (Fig. 5). He obtained great relief from the operation.

Plastic restoration of the cheek was begun on June 23 and completed in August 1943 (Figs. 6 and 7). A year later one minor plastic procedure was carried out. Closure was accomplished by a tube pedicle graft from the chest wall, carried up in stages. There was no recurrence of the cheek cancer, but the patient died of cancer of the esophagus two years later.

CASE 9: W. C. T., a man of 65, was first examined at my office in February 1944. He stated that in May 1943 a sore had appeared on the inside of his right cheek and gum. Erosion of the jaw developed, which was thought to be osteomyelitis. Cultures were taken but never a biopsy until it was demanded by the radiologist to whom he was referred. By this time the lesion was very extensive. The radiologist gave 2,000 r at 200 kv., but there was no response and the lesion became much larger.

On examination there was an extensive carcinoma extending from the right commissure back to the angle of the jaw, with a larger perforation in the cheek. The patient was in great pain and was unable to take proper nourishment. There was no involvement of the nodes in the neck.

The situation was discussed frankly with the patient. He was told that the only chance of cure was by a very radical operation which would carry

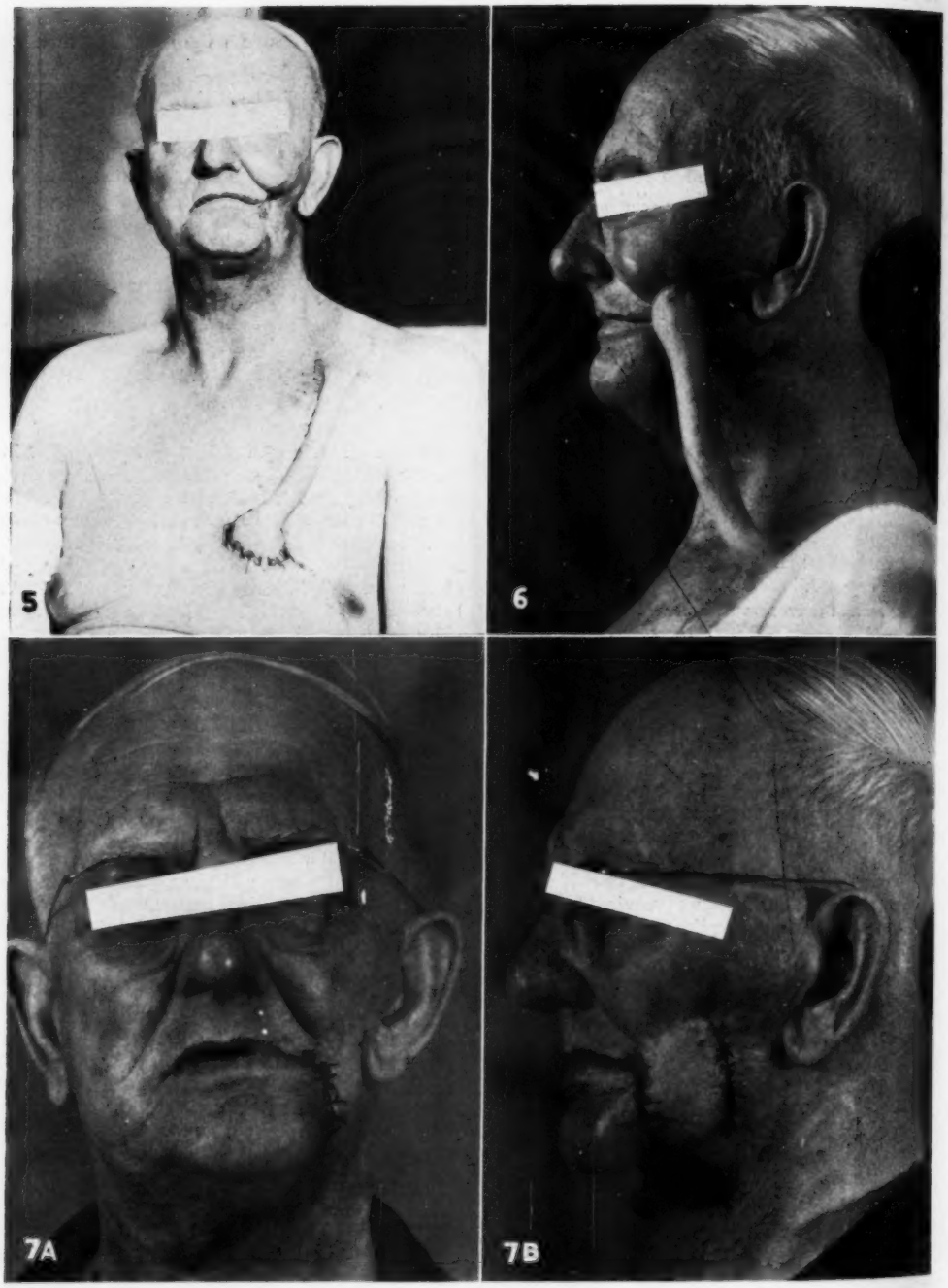

Fig. 5. Case 8. The area of destruction of the face and jaw is visible. The first and second stages of the tube pedicle flap have been completed.
Fig. 6. Case 8. The tube pedicle has been attached to the face.
Fig. 7A and B. Case 8. The base of the flap has been trimmed and sutured in place.

Fig. 8A and B. Case 9. Cancer destroying the jaw, cheek, and chin. Roentgen therapy had not been effective.

a high risk. Even then, he was told, there was no promise of cure. After thinking the matter over a few days and after being told by another surgeon that no operation should be done, he agreed to operation.

He was admitted to the Pondville Hospital on Feb. 22, 1944. Two weeks were spent in cleaning up the slough and getting rid of the sepsis. When this was done, the pain nearly disappeared and it was possible to take more nourishment.

On March 6, 1944, operation was performed under intratracheal anesthesia. An incision was made beneath the jaw, outside of all indurated tissue. The external maxillary artery was divided as it entered the submaxillary gland. Incisions were made forward to the mid-line of the jaw and back to the angle, and the two incisions were connected above the tumor. The jaw was divided through healthy bone at the symphysis and at the angle. All gross disease was removed. This left a large defect through the full thickness of the cheek. The commissure was reconstructed. A transfusion was given during the operation. The patient was in fair condition. He was very cooperative in the postoperative period, took fluids well, and recovered rapidly.

The pathological report was "epidermoid carcinoma, grade I, with invasion of mandible. Three negative lymph nodes." The lack of metastases in this case made operation possible and cure probable.

Reconstruction operations were performed. These consisted in constructing a tube pedicle flap from the chest wall in several stages, transferring one end to the parotid region, and later using the other end to connect up with the lower lip (Figs. 9 to 11). The bare area on the chest was covered with skin grafts. Several minor plastic procedures were done about the cheek and lip. Reconstruction was completed in eight months. During this time the patient regained his former health and took an adequate

Fig. 9. Case 9. A tube pedicle flap has been constructed on the chest wall. The other scars are the results of failure of the first graft. (See also Figs. 10–12)

Fig. 10. Case 9. The tube pedicle graft has been sutured to the face.
Fig. 11. Case 9. The tube has been divided and the unused portion dropped back (to be discarded later).
Fig. 12A and B. Case 9. Final result after reconstruction.

amount of soft food. He was last seen on Oct. 23, 1947 (Fig. 12). There has never been any recurrence and he is well and happy.[2]

[2] This patient presented himself at the meeting at which this paper was read, three years after operation. He had no lymph node metastases and had returned to his former occupation.

Surgical reconstruction in these cases is long and tedious. The new cheek must have proper outside and inside layers, made up of skin and fat. The best method is by a tube pedicle graft constructed from the chest wall. If the patient is very thin,

this does not always give sufficient thickness to form both layers. In such cases two delayed flaps must be lifted up and one used to line the other. Ordinary skin grafts used to line a flap are not satisfactory, for the flap tends to pucker up toward the thin side.

It is necessary to remove all the scarred tissue around the defect and even then tissues are slow to heal. Many cases require ten or twelve stages to finish the reconstruction. Most of our patients have been very cooperative and appreciative. Functional results are sought rather than a fine cosmetic effect. These patients get along very well with only one jaw, though there is always the possibility of bone grafting to replace the jaw. Usually they are so happy to be relieved of pain and to have their fistulas closed that they are content to get along as they are. Some of them have been fitted with very satisfactory dental prostheses.

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SUMARIO

Necrosis Irradiatoria de la Mandíbula

Todo radiólogo que trata cáncer de la cara y boca ve algún caso que otro de necrosis mandibular. Mientras más enérgico el tratamiento, más probabilidades hay de curación del cáncer y más posibilidades de necrosis. A fin de enseñar ciertas lecciones pertinentes, preséntanse los protocolos de nueve casos seleccionados. Entre dichas lecciones figuran la importancia de la extracción, antes del tratamiento, de todos los dientes que va a atravesar el haz de rayos X y de todos los que se hallen cariados o desvitalizados dondequiera que estén; evitar las extracciones dentales por varios años después de la irradiación; cuidadosa atención a la higiene bucal inmediatamente después del tratamiento y rápido cuidado de toda infección subsiguiente en la zona irradiada o adyacente a la misma; y valor de la electrocoagulación quirúrgica para cohibir la propagación de la necrosis.

La reconstrucción quirúrgica consecutiva a una necrosis extensa representa un procedimiento largo y fatigoso. La mejor técnica consiste en un injerto pedicular en tubo, construído de la pared torácica.

Roentgen Irradiation of Thrombophlebitis[1]

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THE LITERATURE having to do with the therapy of thrombophlebitis is voluminous, especially the surgical methods of treatment and the arguments as to when to and when not to operate. In recent years, the use of anticoagulants, especially heparin and dicumarol, has been added to the armamentarium. In some large clinics, heparin and dicumarol are used particularly for postoperative prophylaxis against thrombosis and embolism. Another procedure that is being employed is the sympathetic block. Any method of treatment which will save the patient's life is valuable, but to date there is no "cure-all." Surgeons use the venogram to locate the site of the thrombus, and some employ it as a guide in determining whether or not to operate. I believe that advantage is not being taken of all the resources available unless radiation therapy is utilized in some cases.

Soon after the discovery of x-rays, the radiation treatment of inflammatory diseases was instituted, and the employment of radiation therapy in thrombophlebitis is not a new procedure. It has been used in isolated cases for some time. In the *Medical Record* for 1906, J. C. McGuire (12) reported two cases of varicophlebitis with concomitant ulcer formations treated successfully by radiation. In 1913, G. de Vecchi (cited by Henschen and Becker, 7), at the first Congress of the Italian Radiological Society reported on "some cases of varicophlebitis cured by roentgen rays."

In spite of the increased use of radiation therapy for various other diseases, its employment in the treatment of thrombophlebitis remained apparently unnoticed and undeveloped. In 1925, Herman B. Philips and Isidor S. Tunick (14) presented a preliminary report concerning its use in 50 cases of circulatory disturbances of the extremities, mostly thromboangiitis obliterans. In 1930, Josef Halban (6) reported 17 cases of thrombophlebitis successfully treated by irradiation. Since that time, several reports have appeared, the most extensive one being that of C. Henschen and F. Becker (7) in 1937.

One must remember that venous thrombosis occurs under a wide variety of circumstances. It is associated with injury, operation, childbirth, and the serious diseases which confine patients to bed, as well as the less common ones of active life. In the light of present-day research, which has culminated in the clinical observations of Bauer (2) and the pathological studies of Hunter and his associates (10 and 11), it is clear that most venous thromboses begin below the knee. One must therefore get away from the old idea that thrombosis in the lower limbs usually starts in the upper femoral and lower iliac veins. It is true, of course, that venous thrombosis does sometimes begin in the region of the groin and even in the veins of the pelvis. The pathologists agree, however, that, as a rule, thrombosis in the deep veins of the legs not only starts below the knee, but that such a process may, in its development, give rise either to non-obstructive masses in the femoral and iliac vessels, namely, phlebothrombosis, or to the complete obstructive inflammatory condition, thrombophlebitis.

Posture, exercises, better surgical principles, and improved care of the non-surgical cases have reduced the incidence of thrombosis, but in spite of all these precautions, definite problems still remain to be solved in this disease. Among these are swelling of the leg, fever, leukocytosis, and elevated sedimentation rate. Also there is a fulminating, acute inflammatory

[1] Presented at the Thirty-third Annual Meeting of the Radiological Society of North America, Boston, Mass., Nov. 30–Dec. 5, 1947.

thrombosis of the leg veins which seldom becomes fatal. On the other hand, in phlebothrombosis diagnosis may not be made until the occurrence of lung infarct or even autopsy.

Diagnosis must be made early, at a time when only the venous areas have been attacked and when the clinical signs are vague. Usually the first symptom in thrombophlebitis is pain in the calf of the leg or the foot, the significance of which is often overlooked unless it is constantly kept in mind as a possibility in such cases. Bauer and his associates reported that the most constant sign is a tenderness to deep palpation over certain segments of the back of the calf (3, 4). In the presence of this symptom, thrombosis is probable but not certain.

When phlebograms were made on a series of patients with tenderness, mild swelling of the leg muscles, and pain, one-third to one-half of them were found free of thrombosis. Therefore, appraisal of all the clinical signs as well as skillful phlebography should be the diagnostic procedure in early suspected phlebothrombosis. Once the diagnosis of acute thrombophlebitis has been made, treatment should be instituted without delay.

The following cases illustrate the value of radiation therapy in this condition:

CASE 1: Mrs. V. B., aged 51, was admitted to St. Luke's Hospital April 15, 1945. Her earlier history was irrelevant except that five months previously she had been operated upon for a ruptured appendix. There was drainage for six weeks, accompanied by low-grade fever. After the operation, the patient complained of aching pain in the right lower quadrant, pain on defecation, and a more or less constant dull ache in the rectum. Because of the continued pain, she sought medical advice. There was tenderness in the right lower quadrant, and vaginal examination revealed a mass in the same area.

At operation, April 15, 1945, a large, hard, fixed mass with the intestines attached to it was encountered in the right pelvis. A hole in the large intestine was sutured, and a section was taken for pathological study. The pathologist's report was papillary adenocarcinoma.

Three days following operation, the patient began to have pain in the right leg. The next day, there was some swelling of the entire leg; the temperature rose to 101° F., and the pulse was 94. A diagnosis of thrombophlebitis was made. Hot packs were applied to the leg without relief. The surgeon, Dr. W. W. Haggart, considered operation impossible, and consulted the author because of the malignant lesion in the pelvis. Irradiation therapy was advised. This was directed to both the pelvis and the leg. In twelve hours the pain had ceased, and in forty-eight hours the swelling had begun to subside. It was completely gone at the end of four days, but irradiation was continued on account of the neoplasm, which led to the patient's death a year later.

CASE 2: Mrs. C. Y., aged 70, was admitted to St. Luke's Hospital May 5, 1945. She gave a history of asthma for several years and of hypertension for the preceding two years. She had been on a reducing diet for six weeks and had lost fifteen pounds. Five days before admission she had vomited and experienced pain in the right lower quadrant, extending into the buttocks. Heat applied by means of a hot-water bottle gave some relief, but the pain was replaced by another in the epigastrium (cramping, intermittent). The patient had not defecated since the vomiting began.

Examination was negative except for some abdominal distention and tenderness in the right lower quadrant. X-ray examination revealed dilatation of the small intestine and absence of gas in the colon, indicating intestinal obstruction. Partial relief of the distention was obtained with the Miller-Abbott tube.

The patient was operated upon on May 10, 1945, and a small intestinal obstruction was found. She improved, but on May 13, she began to complain of some pain in the calf of the right leg, which became swollen and edematous the following day. A diagnosis of thrombophlebitis was made by her surgeon, Dr. W. W. Haggart, who immediately called the author in consultation. Radiation therapy was instituted. The following day the pain was relieved and the next day the swelling was receding. When the patient was dismissed from the hospital, June 1, 1945, there was no sign of thrombophlebitis.

CASE 3: Mr. F. N., aged 63, was referred by Dr. Paul Connor on Dec. 17, 1946, for therapy for chronic thrombophlebitis. In 1942 he had an illness which, after two weeks, was diagnosed as gallbladder disease. (The diagnosis was later confirmed by x-ray examination, but the patient was never operated upon.) One week later he complained of pain in the left leg, followed by swelling, and a diagnosis of phlebitis was made. He wore an elastic bandage for a year and the swelling subsided. In 1945, the patient had pneumonia. One week after he left the hospital, as he was going in to dinner, he had a sudden sharp pain in his chest, with shortness of breath, and fainted. This episode was attributed to a "heart attack," but correct the diagnosis was probably an embolus. Two days later, pain in the left leg recurred, followed by swelling of the leg to the groin. The patient was confined to his bed for forty-

five days. He subsequently sought medical aid in various clinics without improvement, and was eventually referered to Dr. Connor for advice about ligation of the veins. Dr. Connor advised radiation therapy rather than surgery.

Examination showed marked swelling and tenderness of the entire left leg, with some pitting of the tissues below the knee. There was also a bursitis of the left shoulder, due to a fall in 1942. Therapy was begun on the leg and, at the patient's request, treatment was also given to the shoulder. Six weeks after the first treatment the shoulder was painless and there was very little limitation of motion. The swelling of the thigh and leg was reduced and at the end of three months had disappeared except when the patient had been on his feet for three or four hours. There was no longer any pitting of the leg. At the present time an elastic bandage is still worn and there is some swelling after the patient has worked five or six hours but there is no pain. The swelling subsides after a few hours of rest. Besides the gallbladder disease, a kidney condition is now present.

CASE 4: Mrs. C. B., aged 57, was referred by Dr Paul Connor for treatment of chronic thrombophlebitis. She had undergone amputation of the left breast eleven years earlier because of a growth which proved, on pathological study, to be nonmalignant. Four years later, a mass discovered in the right breast was removed; it, too, was reported by the pathologist to be benign. Following the second operation, phlebitis of the left leg developed. Six spinal blocks were done, but the condition was unimproved, and the patient complained of the leg being cold.

Examination showed some swelling and tenderness of the entire limb, more marked in the calf. There was slight dilatation, also, of the veins in the right leg. Irradiation therapy was begun at the hospital and continued at the office.

Following the fourth treatment, the pain was somewhat lessened, and the leg was warmer. One month later, the patient was feeling much better; the leg was warm, and there was no pain, although there was some swelling in the afternoon. Two months after this, there was still no pain in the leg; though there was occasional afternoon swelling when the left leg would become one and one-half inches larger then the right, but the next morning it would be back to normal. The patient reported by letter six months following her last treatment. At that time, there was no pain and the swelling was less than that formerly noted.

CASE 5: Mrs. E. L., aged 72, was admitted to St. Anthony's Hospital, March 21, 1947. She had had an appendectomy twenty-six years earlier and a tonsillectomy thirteen years after that. Three months prior to admission she began having a feeling of pressure in the lower abdomen and the sensation of pressure on the rectum and bladder. This was augmented when she was on her feet. She had had frequency of urination and incontinence for a number of years. There had been no bleeding or vaginal discharge.

Examination revealed a large movable mass, about 12 cm. in diameter, in the right lower quadrant, and apparently a small uterine fibroid. On March 22, 1947, hysterectomy was performed, and a large right ovarian tumor was removed. It appeared to be malignant with peritoneal metastases. The pathological report was dysgerminoma of the right ovary, atrophy of the uterus, myofibroma of the uterus.

On April 3, 1947, the patient began having pain in the right leg, which disturbed her rest. The following morning, there was some swelling of the ankle. A diagnosis of thrombophlebitis was made, and hot packs were applied. The right leg remained somewhat swollen, and there was tenderness, with some pain. The patient was discharged from the hospital April 8, 1947. Eight days later (April 16) she was referred to me for therapy of the ovarian tumor. At that time, she said that the leg was practically the same as when she had left the hospital. When she appeared for her fourth treatment, she volunteered the information that the pain in the leg had ceased, tenderness was gone, as was most of the swelling, though I had not suggested to her that any possible benefit to the leg condition might accrue from the irradiation therapy.

The treatment factors in this last case were 200 kv., distance 50 cm., filter 0.75 mm. copper plus 1.0 mm. aluminum, 250 r (measured in air) per treatment area. For the other patients the factors were: 200 kv., distance 50 cm., filter 0.5 mm. copper plus 1.0 mm. aluminum, 150 r (measured in air) per treatment area. The best results were obtained from irradiating both the iliofemoral region and the calf of the involved leg, especially from the popliteal space downward, unless the lesion extended above the knee joint. I believe the dosage should be varied according to the severity of the involvement, and the condition should be treated like any other inflammatory disease. If the inflammation is severe, 50 to 75 r should probably be given at the first treatment, and the range should be between 100 and 200 r per treatment area. Also, the location, kind of infection, age, and general condition of the patient should be considered in determin-

ing the dosage, as in any other disease. In all cases, proper measures should be taken to prevent an embolus.

Although to date my experience with radiation therapy in the treatment of thrombophlebitis has been limited, the obviously good results obtained from use of irradiation seem to indicate that it should be added to the numerous other methods of therapy which are so fully reported in the literature. Certainly, the salutary results produced in the cases reported warrant further investigation of this method of treatment, and perhaps its inclusion as another valuable adjunct for the relief of the discomfort of this condition.

In conclusion, I wish to emphasize the importance of radiation therapy of thrombophlebitis for the following reasons:

1. It shortens the duration of the illness.
2. It relieves the symptoms more rapidly than many other therapeutic agents.
3. It provides a means of treating the deep veins in the pelvis when surgery is not practicable.
4. It is a method which can be utilized in acute, subacute, and chronic cases.

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SUMARIO

Irradiación Roentgen de la Tromboflebitis

Comunícanse seis casos que demuestran el valor de la radioterapia en la tromboflebitis. En todos ellos se alivió el dolor y desapareció o disminuyó considerablemente el edema de la pierna.

En todos los casos, menos uno, en el cual la majoría fué consecutiva a la irradiación por un tumor ovárico, los factores fueron: 200 kv., distancia 50 cm., filtro 0.5 mm. de cobre más 1.0 mm. de aluminio, 150 r (medidos al aire) por zona tratada. Los mejores resultados se obtuvieron al irradiar tanto la región iliofemoral cuanto la pantorrilla de la pierna afectada, sobre todo del espacio poplíteo hacia abajo, a menos que la lesión se extendiera hasta más arriba de la rótula. La dosis debe variarse conforme a la gravedad de la afección, y el estado debe ser tratado como cualquier otra enfermedad inflamatoria. Si la inflamación es intensa, deben probablemente administrarse 50 a 75 r en el primer tratamiento, con una escala de 100 a 200 r por zona tratada. Al determinar la dosis, hay que tomar en cuenta, la localización, clase de infección, edad y estado general del enfermo. En todos los casos, se tomarán medidas adecuadas para impedir una embolia.

Recomiéndase el procedimiento por acortar la duración de la enfermedad, aliviar los síntomas más rápidamente que otras muchas medidas y facilitar un medio de tratamiento de las venas profundas de la pelvis cuando la cirugía no resulta factible, pudiendo utilizarse en los casos agudos, subagudos y crónicos.

Carcinoma and Other Neoplasms of the Male Breast[1]

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CANCER OF THE MALE breast is rare and the end-results are disappointing. Among the factors that contribute to the poor prognosis is the fact that to many physicians mammary carcinoma in the male is something of a myth—an oddity in medicine—and for that reason inconsequential. Unfortunately, both the medical profession and the layman underestimate any mammary lesion in the male, and diagnosis is made too late for adequate intervention to effect a cure.

The infrequency of tumors of the male breast may be explained on both anatomical and physiological grounds. Most textbooks of anatomy present an erroneous impression of the male mammary gland. Cunningham and Gray pass over the subject superficially, describing the male breast as a vestigial and rudimentary organ, and one is left with the impression that it contains only scraps of glandular tissue. A good anatomical description is to be found in the paper by Andrews, whose observations are based on sections of normal breasts taken from subjects of all ages. It was found that in every male breast there is a complex series of ducts and alveoli. These are lined by a single layer of columnar epithelium, are patent, and are embedded in a dense connective tissue. Each patent duct has an opening through the nipple. Surrounding the ducts is a sharply differentiated tissue which consists of less deeply staining fibers containing a greater number of nuclei. Andrews claims that this periductal tissue resembles growing tissue and is often mistaken for proliferating fibrous tissue. The adult male mammary gland is in essentially the same state as in preadolescent girls. While the female gland continues to undergo great functional activity (as in menstruation, lactation, and pregnancy), the male gland remains in the so-called rudimentary stage. The rare occurrence of carcinoma of the male breast is in accord with the general rule that cancer seldom arises in vestigial organs.

Geschickter emphasizes the relation of the rarity of cancer in the male breast to the absence of intense endocrine stimulation by ovarian hormones, and Cheatle and Cutler furnish experimental evidence to substantiate this thesis. Reducing the amount of ovarian hormone and the duration of its action on the female breast lowers the percentage of spontaneous carcinoma in mice, and vice versa.

HISTORY

Despite the relative infrequency of carcinoma of the male breast, as compared to the same disease in the female, a sufficient number of cases appear in the literature to indicate the importance of the disease not only to the patient and general practitioner, but especially to the surgeon and radiation therapist. The earliest reference to cancer in the male breast was made by Franciscus Arcaeus (1493–1573). Up to 1890 Schuchardt had collected 472 cases. The first reference in the English literature to carcinoma in the male breast was in 1889 by Williams, who reported on 100 cases. Subsequently sporadic reports occurred until 1927, when Andrews' paper, referred to above, was published.

There have been treated on the surgical wards or in the Radiation Therapy Clinic of Bellevue Hospital, during the period July 1924 to July 1946, 1,141 malignant

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lesions of the breast, 1,116 of which were in the female and 25 in the male. This group of 25 includes 6 cases reported in 1931 by one of us (R. R.). In addition, 27 benign tumors of the male breast were seen in the ten-year period from 1936 to 1946.

INCIDENCE

Since tumors of the male breast are relatively infrequent, one finds few reports which include enough cases to permit an extensive study of the incidence and other aspects of the disease. A report from the Census Bureau of England and Wales in 1926 showed that of a total of 5,339 cases of breast carcinoma 0.08 per cent occurred in males. A report from Johns Hopkins Hospital (1889–1931) listed 9 out of 950 breast carcinomas as occurring in the male, and Sachs, in 1941, reporting on 205 cases of male breast cancer collected from leading surgeons, radiologists, and pathologists in the United States and Canada, found the ratio to female breast cancer to be 1.32 per cent. Peck's figure was a bit higher—2.5 per cent, while ours is 2.2 per cent.

ETIOLOGY

Heredity is regarded as of secondary importance in the etiology of cancer of the breast in males, primarily because it is so often difficult to obtain a reliable history. Of Judd's 17 patients, 4 gave a positive history of cancer. Positive histories were obtained in 2 of Finsterer's series of 11, and in 4 of Peck's 12 cases (33.3 per cent). In 3 of our 25 cases there was mention of cancer in the family history.

Age: Most authors agree that carcinoma affects the male breast later in life than the female breast. Williams gave the average age of onset as fifty years, and Wainwright as fifty-two years. Occasional instances in the young are reported. Blodgett's patient was twelve years of age. In our series the average age was 56.6 years, the youngest patient being twenty-nine and the oldest eighty-two. Of the 25 patients, 7 were between sixty and sixty-nine years of age, 3 between seventy and seventy-nine years, and 2 over eighty. Our average age is somewhat higher than those reported previously. The patients, however, were entirely municipal patients and from the poorer class. Most sought their first medical attention late in the disease.

Race: Some authors have reported a fairly high percentage of carcinoma of the male breast in Negroes. Three of 9 cases reported by Lewis and Rienhoff from Johns Hopkins were in Negroes. Our series also included 3 Negroes.

Trauma: One is impressed by the emphasis which has been placed on the relation of trauma to carcinoma of the male breast. Despite the difficulty of determining a direct relationship, one cannot but be influenced by certain cases in the literature. The growth may be followed by acute trauma, as from a direct blow. Murphy reported carcinoma in a breast struck three months previously by a thrown bottle. Peck recently reported an interesting case in which a breast carcinoma developed eight months after the fracture of three ribs in an automobile accident. One of our patients had been struck on the left breast by a chair two months before admission. After the initial pain disappeared, he noticed a swelling at the site of the injury. On admission to the hospital, biopsy revealed carcinoma. Another patient claimed to have noticed a mass in his breast after being hit by the handle of a pushcart. Immediately after the injury the area was somewhat swollen and tender. The following day a small lump, the size of a pea, was noticed just above the nipple. It gradually increased in size, and six months after the injury aspiration yielded a blood-tinged fluid. Six months later the patient was admitted to another hospital, where a cystic mass was removed. Histologic examination revealed carcinoma.

Chronic irritation as an etiologic factor in carcinoma has been demonstrated both clinically and in the experimental laboratory. Such instances as squamous-cell carcinoma of the lip in heavy smokers, cancer of the tongue or cheek associated with a jagged denture, and cancer of the

cervix following lacerations incident to childbirth are the most frequently cited examples. For these reasons, one finds some authors stressing the importance of occupation as an additional causative agent in the development of cancer in the breast. Rodman mentioned a case in a laborer who continuously rested against a shovel handle, and one in a shoemaker, who for years had pressed a last against his breast. None of our patients had an occupation that could have produced pressure on the breast. One, however, had worn a body cast for six months, causing irritation of the right breast.

Previously Existing Tumors: Three of Gilbert's 47 patients had previously had benign tumors of the breast removed. Nine had gynecomastia, and Gilbert claims that breasts which undergo a hyperplasia of the glandular elements are more liable to carcinomatous formation. In 3 of Geschickter's 30 cases there was an associated gynecomastia. Menville reported 2 cases of gynecomastia followed by cancer. Ewing states that unusual development and activity of the breast are predisposing conditions for mammary cancer in the male. On the other hand, Cheatle and Cutler are of the opinion that the development of carcinoma in a breast which is the seat of gynecomastia is so rare that the event may be regarded merely as a coincidence.

None of our series of patients gave a history of pre-existing benign tumor or undue swelling of one or both breasts. Three, however, gave a long history of a small lump in the breast which had started to grow most rapidly only a few months before admission.

Influence of Hormones: We have already stated that the rarity of cancer in the male breast can be attributed, in part, to the lack of stimulation by ovarian hormones, which in the female cause physiological changes during menstruation, lactation, and pregnancy. When one comes to consider the relation of gynecomastia to hormonal stimulation, and possibly to cancer formation, it can be seen how closely these factors are related. Experimental and clinical observations have been reported which establish a close etiological relationship between gynecomastia and abnormalities in sexual structure and function. Steinach (as quoted by Cheatle and Cutler) castrated male guinea-pigs and caused overgrowth of the mammary glands in these animals by implanting ovarian tissue. Ferguson showed that enlargement of the breasts in male animals can occur as a result of induced endocrine imbalance. Bischoff studied the effect of injecting large doses of estrogen in certain strains of male mice, both castrated and intact. In none of the intact mice did cancer develop, but in 6 per cent of the castrated animals adenocarcinoma of the breast appeared. Geschickter has shown that in male mice and rats, whether castrated or not, mammary cancer arises in the same frequency as in the female if intense estrogenic stimulation is applied.

In connection with cancer of the female breast in mice, Rhoads mentioned evidence pointing to the fact that in certain pure strains two factors are important etiologically: the hereditary factor, which is transmitted by the maternal parent, and a second factor contained in the milk. In the presence of both factors (heredity and milk) rhythmic secretion of estrogen is responsible for the growth of breast cancer. In the presence of an existing breast carcinoma, the administration of ovarian hormone makes the disease worse.

Clinically, there has been observed a tendency to increased development of the breast in males when the function of the testes is depressed or destroyed by disease, as is frequently the case in mumps. Similarly enlargement of the breasts following prostatectomy has been noted. Gilbert refers to the case, reported by Villian, of a man who had been operated upon twelve years previously for benign hypertrophy of the prostate. Following the operation, bilateral gynecomastia occurred (both breasts being the type and shape of the female gland), and later a typical cancer of the right breast developed, with metas-

tases. Two of our patients gave a history of prostatectomy for benign hyperplasia one month and six years, respectively, before admission with breast carcinoma. The breasts revealed no evidence of gynecomastia.

Cheatle and Cutler do not feel that gynecomastia is due to failure of testicular secretion. They report cases of gynecomastia in two youths whose sexual development was normal. The 10 patients with gynecomastia in our series (8 with histologic proof) did not manifest abnormal sexual development.

Stonham reported a case of breast cancer in a twenty-seven-year-old British soldier whose history appears to combine the factors of endocrine disturbance, chronic irritation, and pre-existing tumor. The patient complained for five months of a small swelling beneath the left breast, which was under the continuous irritation of his web braces. The mass was attached to the nipple but to nothing else. One month after its discovery, it became very painful and red after the patient had marched with his equipment. Excision revealed carcinoma, and a radical mastectomy was performed. Six months later, an adenoma of the right breast developed. The patient's appearance suggested the possibility of some endocrine abnormality and the writer felt that it was highly probable that the tumor under the left nipple commenced as an adenoma and eventually became malignant as a result of chronic irritation.

SYMPTOMATOLOGY

Duration: It has been shown that the average period between the time the carcinoma is first noticed and clinical examination is usually longer in the male than in the female. In our series of cases, the average duration of symptoms was 3.14 years, the range was from one month to twenty-five years. Nine patients (36.0 per cent) had their first clinical examination within six months, 5 (20.0 per cent) within six months to one year, 6 (24.0 per cent) within one to two years, 4 (16.0 per cent) within six to ten years, and 1(4.0 per cent) after twenty-five years.

Pain: Pain does not occur until late in the disease, concurrent with either ulceration or nipple retraction or both.

Skin Attachment and Nipple Retraction: Nine of Gilbert's 47 cases showed nipple retraction. Of Sachs' cases, 33.1 per cent showed retraction. Seventeen of our 25 patients, or 68.0 per cent, had skin attachment and 8 (32.0 per cent) had typical nipple retraction.

Nipple retraction and skin attachment in the male may occur in association with any type of tumor or even infection of the breast, and may be interpreted as signs of cancer. This is due to the close proximity of the pathological process to the terminal ducts. In 12 of our 27 benign tumors (44.4 per cent) attachment to either skin or nipple was observed. The diagnosis of cancer in the male is thus made more difficult and the above signs are in themselves insufficient evidence of malignancy. In our series of benign tumors, there is included the case of a fifty-six-year-old man who was admitted with a large mass in the left breast which, on clinical examination, had all the characteristics of cancer except ulceration and discharge. Even at operation the gross appearance seemed cancerous, and it was decided to perform a radical mastectomy. Pathologic examination later revealed gynecomastia. In all cases, especially where the diagnosis is uncertain, one must perform a biopsy before subjecting the patient to a radical mastectomy.

Ulceration: Because of the meager adipose tissue in the male breast and the fact that the carcinoma is usually located close to the nipple and skin, the percentage of cases which manifest ulceration and discharge is relatively higher in the male than in the female. In our series, 28.0 per cent had ulceration on admission.

Side Involved: Some authors claim that there is a predominance of carcinoma in the left breast. Gilbert reported 26 patients with involvement of the left side and 20 of the right. In our series, the reverse was

true. The left side was involved in 10 and the right in 15 patients.

Involvement of the Pectoral Fascia and Muscle: Speese reported invasion of the pectoral fascia in 35 per cent of his cases and involvement of the pectoral muscle in 25 per cent. In our series, there were pathological examinations for pectoral muscle involvement in 9 cases, 3 of which showed involvement by carcinoma (33.3 per cent). These percentages are probably higher than for females, since in the latter the muscle is usually farther away from the primary tumor; its involvement in the female should therefore be accepted as of much graver import than in the male.

Axillary Involvement: Because of the limited amount of fatty tissue in the male breast, there is an early spread by continuity to the pectoral fascia and muscles (as discussed above) and to the axillary nodes. One must be careful, however, when evaluating the incidence of axillary involvement, to make certain whether the nodes were merely palpated on clinical examination or were found at operation and proved histologically.

Cheatle and Cutler found involvement of the axillary nodes in 60 per cent of cases at operation or autopsy. All of Peck's cases with node involvement (80 per cent) were verified by histologic study. He attributes his high incidence to the fact that all of his patients were on the public wards. Taylor and Nathanson showed that in the Massachusetts General Hospital, 65 per cent of all breast cancers seen on the public wards showed axillary metastases, while on the private wards the incidence was only 48 per cent. Of our 25 patients, 18 (72.0 per cent) were found to have palpable axillary nodes on their first clinical examination, and in 15 (60.0 per cent) cancer was proved pathologically. All of our patients were on the public wards.

Distant Metastases: As the disease progresses, the supraclavicular and mediastinal lymph nodes become involved and eventual metastasis takes place to the lungs, liver, bone, brain, and abdominal cavity. In the male, the percentage of patients that reveal distant metastases at the time of clinical examination is higher than in the female. For this reason, many of the cases are inoperable when first seen by the physician.

CLINICAL CLASSIFICATION

It is difficult to correlate operable and inoperable figures of different workers because of the variation in criteria of operability.

Based upon results of the first clinical examination, we have classified our 25 cases of male breast carcinoma as follows:

1.	Breast alone	6 (24.0 per cent)
2.	Breast and axillary metastases	13 (52.0 per cent)
3.	Breast, axilla, and distant metastases	5 (20.0 per cent)
4.	Breast, plus other coexisting condition, making case hopeless	1 (4.0 per cent)

Groups 1 and 2 above were considered to be operable (76.0 per cent) and Groups 3 and 4 inoperable (24.0 per cent). We have included in our operable group those patients with axillary node involvement. Some authors would place these cases in a borderline group; if we did so, our primary operable cases would amount to only 24 per cent.

PATHOLOGY

The pathology of carcinoma in the male breast does not vary greatly from that in the female. In our series, we were able to obtain pathological reports in 22 of the 25 cases. The pathological diagnoses were made by biopsy, frozen section, operative specimens after mastectomy, or autopsy findings. In all 22 cases gross and microscopic descriptions were included. Among the 22 cases we found:

Duct-cell carcinoma	6 (27.3 per cent)
Carcinoma (undifferentiated)	3 (13.7 per cent)
Scirrhous carcinoma	5 (22.7 per cent)
Adenocarcinoma	4 (18.2 per cent)
Papillary carcinoma	1 (4.5 per cent)
Squamous-cell carcinoma	1 (4.5 per cent)
Basal-cell carcinoma	1 (4.5 per cent)
Fibrosarcoma	1 (4.5 per cent)

The patient with basal-cell carcinoma was admitted to the hospital because of benign prostatic hypertrophy. A prostatectomy was done, and during the postoperative period an erosion of the right nipple developed and similar lesions appeared on the abdomen and back. There was a history of a scaly lesion on the nipple one month before admission. A biopsy of the nipple lesion revealed basal-cell carcinoma, which cleared with radiation therapy. The squamous-cell carcinoma occurred in a seventy-one-year-old man who was admitted with a large ulceration, 12 cm. wide, completely replacing the nipple and areola. The edges were indurated, and biopsy revealed squamous-cell cancer.

The patient with sarcoma was a fifty-eight-year-old man with a mass in the breast of seven years duration. It was large, semisolid, and not attached to skin or underlying fascia. The tumor was first excised at another hospital, and pathologic examination revealed marked proliferation of small spindle-shaped cells surrounded by a fibrous stroma, a portion of which was calcified. Three years later the patient was admitted to Bellevue Hospital for a recurrent mass in the same breast. Pathologic diagnosis after radical mastectomy was fibrosarcoma of the oat-cell type.

TREATMENT

As in cancer of the female breast, carcinoma in the male breast requires early diagnosis and radical surgery. Some surgeons, on examining a small tumor in the male breast, hesitate to recommend its excision. They underestimate the possibility of carcinoma because of its relative infrequency at this site in the male. One of our patients, admitted for removal of a fetal adenoma of the thyroid, was found on examination to have a small nodule in the breast. He did not receive treatment for the breast nodule and returned six years later with a large ulcerated carcinoma with metastases in the axilla, ribs, sternum, and lung.

To evaluate the operability of a cancerous patient one must consider not only the extent of the growth, but also the physical status of the individual. The latter condition has of late become relatively less important because of the remarkable strides in anesthetic technics. There is less hesitancy today to operate upon the elderly, cardiac, or even the tuberculous patient. The extent of the primary malignant growth has thus become actually the more important factor in deciding whether to employ radical surgery or palliative measures. These facts have to be considered when one realizes that carcinoma in the male breast occurs in the more elderly group.

Of our series of 25 cases, 19 were classified as "primary operable," but in only 15 of these was amputation of the breast done. Two patients refused surgery; one, with basal-cell carcinoma, did not require surgery because the lesion cleared rapidly under irradiation; one patient had a local excision of the growth with preoperative and postoperative irradiation. In 11 cases a radical mastectomy was said to have been done, but in one of these the operation did not entail dissection of the axilla, and in another it did not include resection of the pectoralis fascia and muscles. One of the operations was for a recurrent sarcoma three years after an excision of the growth in the same breast.

Of the 6 cases considered not to be primary operable, 3 were treated by simple mastectomy, purely as a hygienic measure because of massive ulcerative primary lesions and distant metastases.

Three patients received radiation therapy alone: one for basal-cell carcinoma, one as a palliative measure because of inoperability, and another because surgery was refused.

Three patients received no treatment at all: 2 who were admitted in a hopeless condition and 1 who refused all treatment and signed out of the hospital.

Earlier, in this paper, we discussed the evidence presented by Rhoads and others showing that sexual hormones may play

an etiological role in female breast cancer. In addition, Farrow and Woodard have shown that injecting testosterone propionate into male patients with breast carcinoma and osseous metastases increased the serum calcium and caused clinical and roentgenologic evidence of increased activity in the metastatic disease in bone. Estrogen produced a similar effect. The authors claimed that the hypercalcemia was due to stimulation by the hormones of growth of the metastatic tumor. Treves and his co-workers therefore attempted to study the effect of orchiectomy on 6 males with breast carcinomas. Of the 6 patients, 5 were inoperable, and 1 was primary operable. The latter had a local excision of the growth plus a bilateral orchiectomy. He was well one year after castration and had no evidence of metastases. Two others with distant metastases were considered to show good results. They were promptly relieved of pain caused by osseous metastases, and x-ray films showed evidence of bone regeneration. One other patient with distant metastases showed no definite improvement. In the remaining two patients the treatment was considered to be a failure.

Leucutia attempted bilateral orchiectomy in 2 cases of male breast cancer with distant metastases. The patient with osseous metastases was symptom-free four months after orchiectomy and x-ray revealed disappearance of the metastatic lesions with reossification of the formerly destroyed areas. Two years later he was still free of carcinoma. The second patient had visceral metastases of a highly malignant medullary carcinoma. Operation was followed by temporary improvement, as manifested by a 20-pound weight gain, but death ensued six months later of generalized metastases and local recurrence.

One of our patients had a bilateral orchiectomy five years after a radical mastectomy for a scirrhous carcinoma of the right breast which had metastasized to the lumbar spine, pelvis, and tibia. He was absolutely bedridden because of a collapse of the body of the fourth lumbar vertebra and had excruciating pain in the back, requiring morphine. Radiation therapy did not improve the metastatic process. Serum calcium studies revealed a slight hypercalcemia (11.6 mg.). Three days after orchiectomy pain was completely relieved and within three weeks the patient was able to walk around the ward with the aid of braces. Up to the writing of this paper (2 months postoperatively), there was no evidence of any roentgenologic change in the metastatic process in the bones, although the serum calcium decreased to 8.4 mg., suggesting that some new bone might have formed. This patient would have to be followed further to evaluate the treatment he received.

Five-year survival rates for carcinoma of the male breast treated by surgery and irradiation are totally confusing. However, they all present the same depressing picture: a poor prognosis no matter what the treatment. It is unfortunate that the diagnosis is made too late for adequate surgery and irradiation to be effective in producing a fairly high percentage of five-year survivals.

In our series we were able to obtain complete follow-up histories on 23 of our 25 patients. Only 7 of these 23 patients were alive without metastases when last seen, three months, five months, six months, one year and six months, three years and two months, five years and three months, and sixteen years after treatment. One of this group received preoperative and postoperative irradiation supplementary to radical mastectomy, 5 had only postoperative irradiation, and 1 was treated by irradiation alone, for a basal-cell carcinoma.

When last examined, 5 patients were alive with metastases one year and six months, two years and six months, three years, five years and four months, and five years and ten months after treatment. Of this group, 3 had radical mastectomies plus postoperative irradiation; 1 had a radical mastectomy without irradiation; 1 had preoperative irradiation also, and the fifth received only radiation therapy because he

refused surgery after having noticed that the lesion practically melted away during the preoperative treatments. This last patient survived the five-year period, but on his last examination he had metastases in skin and supraclavicular lymph nodes.

Of the 11 patients known to be dead, 2 died within six months, 2 within twelve months, 2 within two years, 2 within five years, 1 five years and two months after treatment, 1 six years and 1 nine years postoperatively. Eight of these patients died with metastases from the breast carcinoma. However, one had a concurrent carcinoma of the urinary bladder. The causes of death in 3 patients who died without metastases were cerebral injury, inanition, and pneumonia.

Up to the end of 1946 we were able to follow 16 patients to determine five-year survival rates. In this group, 8 (50 per cent) lived more than five years, but only 3 (18.8 per cent) were free of metastases. Of this group of 16, only 2 were without axillary involvement before treatment, and 1 (50 per cent) of these 2 patients lived more than five years without metastases. In the 14 with axillary metastases, 6, or 42.9 per cent, survived the five-year period, but 4 of them had recurrent metastases. The five-year survival rate without recurrent metastasis for this group was therefore 14.3 per cent.

Considering all patients with or without axillary metastases who were treated radically, the five-year cure rate in female breast cancer, as quoted by various clinics, varies between 30 and 50 per cent. For the cases without axillary metastases the figure is about 70 per cent, for patients with axillary involvement about 25 per cent. The explanation, of course, of the poorer end-results in male breast cancer is that the percentage of patients having axillary involvement at the time of clinical examination is higher than in the female. Other factors that attribute to the poorer prognosis in the male have been discussed previously. In review they are: (1) failure of early recognition by the patient himself and procrastination on his part in visiting his doctor; (2) failure of the family physician to recognize that a mass in the male breast has the same potentialities as in the female breast and should be biopsied to rule out carcinoma; (3) the anatomy of the male breast, which affords greater and more rapid spread to the skin (causing earlier ulceration), pectoralis fascia and muscle, and axillary nodes.

SUMMARY

1. Despite the rarity of male breast cancer, enough cases have been reported in the literature to awaken the layman, the general practitioner, and the surgeon to the fact that the disease does exist and demands early diagnosis and treatment if we are to obtain better end-results than past and present reports indicate.

2. The history of the disease in the male has been reviewed and an additional series of 25 cases is reported from Bellevue Hospital. These comprised 2.2 per cent of all breast cancers seen in a given period.

3. The etiology of male breast cancer has been discussed. Special reference is made to trauma, pre-existing benign lesions, and hormonal disturbances as possible predisposing causes.

4. Carcinoma was seen to affect the male breast later in life than in the female. The average age in the present series was 56.6 years.

5. The duration of symptoms was longer and most cases were diagnosed late in the course. Pain was not a significant symptom. Skin attachment with nipple retraction, ulceration and discharge, and pectoral muscle involvement occurred earlier and more frequently than in the female.

6. Axillary involvement at the time of the first clinical examination was found to be more frequent than in the female (60.0 per cent confirmed pathologically).

7. In our series, 76.0 per cent of the patients were operated upon, and this group included cases with axillary involvement.

8. Pathological examinations were obtained in 22 cases. The most common

lesion was duct-cell carcinoma. Included were: one case of basal-cell carcinoma, one of squamous-cell carcinoma, and one of fibrosarcoma.

9. As to treatment, emphasis is placed on the fact that all discrete lesions of the breast should be examined histopathologically to rule out carcinoma. Diffuse enlargement of one or both breasts, especially during puberty and the climacterium, can be left alone unless the patient demands surgery for cosmetic reasons. Not enough evidence has been obtained to prove that diffuse gynecomastia is an etiological factor in breast carcinoma.

10. Adequate treatment for all cases of cancer entails radical mastectomy with dissection of the axilla in conjunction with radiation therapy. Postoperative irradiation improves the end-results to some extent. We recommend its use more as a prophylactic measure to destroy remaining malignant cells which may not have been entirely removed at the operating table.

11. The influence of hormones as an adjunct in therapy for cancer of the male breast is discussed.

12. The end-results in male breast cancer are very poor. Sixteen patients were followed for five years. The five-year-survival rate was 50 per cent, the five-year-cure rate 18.8 per cent.

13. For 14 patients with axillary involvement, the over-all five-year-survival rate was 42.9 per cent, but the five-year-survival rate without recurrent metastases was 14.3 per cent. The five-year survival rate without recurrent metastases for those patients who had no axillary involvement at the time of operation was 50 per cent.

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SUMARIO

Carcinoma y Otras Neoplasias de la Mama Masculina

A pesar de la rareza del cáncer de la mama masculina, los casos comunicados bastan para poner de relieve el hecho de que se necesitan diagnóstico y tratamiento más tempranos si se quieren mejorar los desfavorables resultados terminales del pasado y del presente. Tras un breve repaso de la historia de la dolencia, se comunica una serie de 25 casos, que representan 2.2 por ciento de los cánceres mamarios observados durante un período dado.

Al discutir la etiología del cáncer mamario en el varón, menciónanse en particular como posibles causas predisponentes el traumatismo, las lesiones benignas preexistentes y los trastornos hormónicos. No se han acopiado datos suficientes para demostrar que la ginecomastia difusa sea un factor etiológico.

El cáncer mamario se presenta en el varón algo más tarde que en la mujer. La edad media en la serie de los AA. fué de 56.6 años. Los síntomas fueron más duraderos y la mayor parte de los casos se diagnosticaron en un período tardío de su evolución. El dolor no constituyó un síntoma importante. La adhesión a la piel con retracción del pezón, ulceración y secreción, y el compromiso del pectoral se presentaron más temprana y frecuentemente que en la mujer. La invasión axilar para la fecha del primer examen clínico también resultó ser más frecuente, observándose en 60 por ciento de la serie ahora comunicada (confirmada patológicamente).

El tratamiento adecuado comprende en todos los casos la mastectomía radical con la disección de la axila y la radioterapia. Setenta y seis por ciento de los enfermos de los AA. fueron operados, considerándose como operables los casos en los que la enfermedad se limitaba a la mama o a la mama y los ganglios axilares. La irradiación postoperatoria pasa por mejorar hasta cierto punto los resultados terminales, recomendándose principalmente para destruir las células malignas que evadieran la extirpación quirúrgica. Los resultados terminales en el cáncer de la mama masculina son malos. Dieciséis de los enfermos de los AA. fueron mantenidos en observación durante cinco años. Ocho (50 por ciento) estaban vivos más de cinco años después del tratamiento, pero solo 3 (18.8 por ciento) de ellos no tenían metástasis.

En 14 enfermos con invasión axilar, el coeficiente global de sobrevivencias de cinco años llegó a 42.9 por ciento, pero el de sobrevivencias sin recurrencias metastáticas sólo a 14.3 por ciento. En los enfermos que no tenían invasión axilar al ser operados el coeficiente de sobrevivencias de cinco años sin recurrencias metastáticas fué de 50 por ciento.

Recálcase el hecho de que, a fin de excluir el carcinoma, todas las lesiones discretas de la mama deben ser examinadas histológicamente. También se discute el influjo de las hormonas como coadyuvante de la terapéutica.

Further Studies on the Radiosensitivity of Tumors Autogenous to Homozygous Hosts[1]

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IN A PREVIOUS communication (1), it was demonstrated that two analogous mammary tumors, both histologically diagnosed as adenocarcinoma, differed widely in regard to radiosensitivity. Thus, implants of an adenocarcinoma grown in one inbred strain of mice (C3H) required a dose of about 2,700–2,800 r to prevent proliferation upon reimplantation into hosts of the same inbred strain, while implants of a second mammary tumor, grown in another inbred strain (dba), and designated dbrB, required about 5,000 r.

An attempt is being made to throw some light on the question as to why two analogous tumors of the same histologic structure, grown in the strains of mice in which they originated, should differ so markedly in radiosensitivity. With this in view, the growth characteristics of these two tumors in tissue culture, irradiated and non-irradiated, and their metabolic activity *in vitro* were studied. The observations made in the course of this study will be briefly presented here.

EXPERIMENTAL PROCEDURE

For the cultivation of the tumors *in vitro*,[2] the same technical procedure was used as in previous studies (2, 3). Peripheral portions of actively growing tumors were cut with a sharp cataract knife into fragments of about 4 to 6 cu. mm. Some of these fragments were placed on a No. 1 cover slip previously attached by a drop of sterile water to a mica sheet, covered with a Maximow's depression slide, in the concavity of which moist filter paper had been placed to maintain the water content of the tissue, sealed with paraffin wax, and exposed to radiation at 12.5 cm. target-tissue distance, from an oil-cooled pulsating potential Coolidge tube. The radiation factors were: 200 kv., 20 ma., 0.5 mm. Cu plus 1.0 mm. Al filtration, and a half-value layer of 0.9 mm. Cu; the average intensity was 604 r per minute ± 10 per cent. The absorption of the radiation by the cover glass and mica sheet, about 10 per cent, was taken into consideration in calculating the dose delivered to the tissue fragments. The dose of radiation was applied in each case in a single exposure.

Within thirty to fifty minutes after irradiation, the tumor fragments were carefully washed in Tyrode solution, cut into fragments of about 1 cu. mm., and placed in a culture medium consisting of a mixture of fowl plasma, rat serum, and chick embryo extract, sealed over a depression slide with paraffin, and incubated at 37.5° C. The same technic was used for control, *i.e.*, non-irradiated, tumor fragments. The cultures were examined daily and maintained for seven to nine days by washing in Tyrode solution and adding fresh medium every forty-eight hours. Some cultures were fixed in Carnoy's solution and later stained with eosin and hematoxylin.

TISSUE CULTURES OF NON-IRRADIATED CONTROL MAMMARY TUMORS OF C3H AND dba STRAINS

Explants of both tumors produced new sheets of epithelium within twenty-four hours of incubation. The explants of

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[1] From the Cancer Research Laboratory, Department of Hospitals, New York City, and the Department of Biology, New York University. Read by title at the Thirty-third Annual Meeting of the Radiological Society of North America, Boston, Mass., Nov. 30–Dec. 5, 1947.

This investigation was aided by grants from the Ella Sachs Plotz Foundation for the Advancement of Scientific Investigation, and from J. C. Brownstone.

[2] The tissue culture work was carried out in co-operation with Miss Gladys Cameron, of the Department of Biology, New York University.

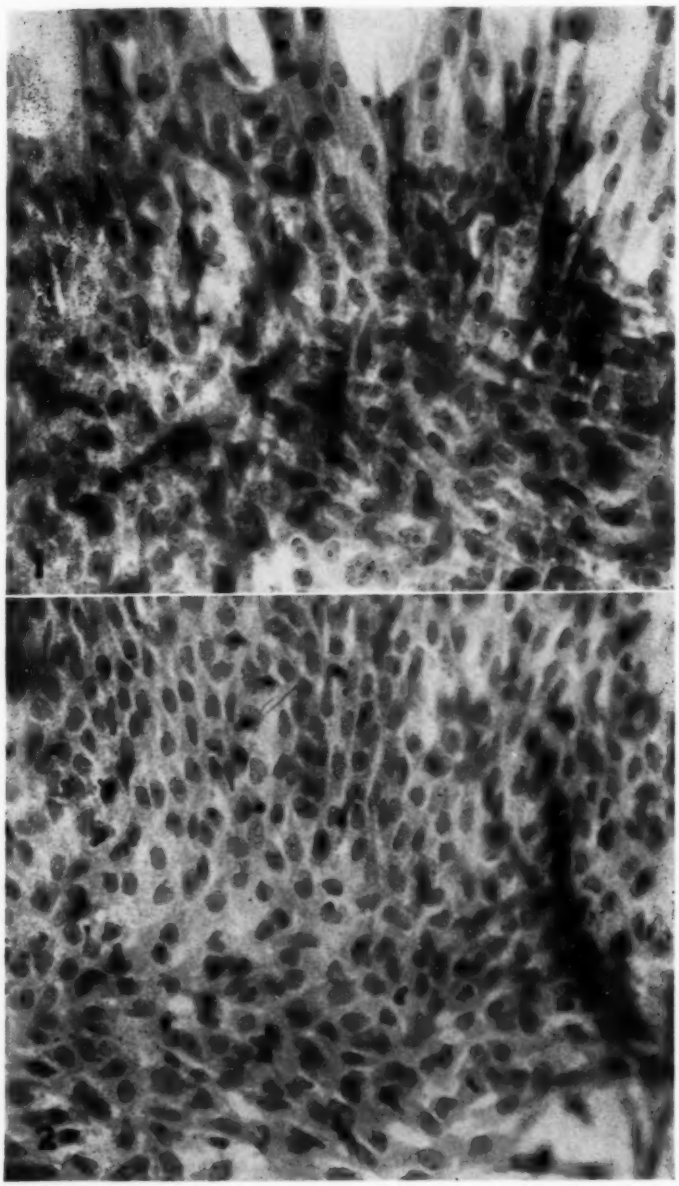


Fig. 1. Photomicrograph of non-irradiated control culture of the mammary tumor of the C3H strain. Note the dense growth of the epithelial sheets, the oval nuclei and distinct nucleoli, the mitotic figures, and some fibroblasts. ×300

Fig. 2. Photomicrograph of non-irradiated control culture of the mammary tumor (dbrB) of the dba strain. Note the loose epithelial sheets, the variation in size of nuclei, the mitotic figures, and the fibroblasts. ×300

the dbrB tumor, however, grew more rapidly than those of the mammary tumor of the C3H strain, as evidenced by a greater number of mitotic figures and the extent of the new epithelial sheets produced within the same period of time.

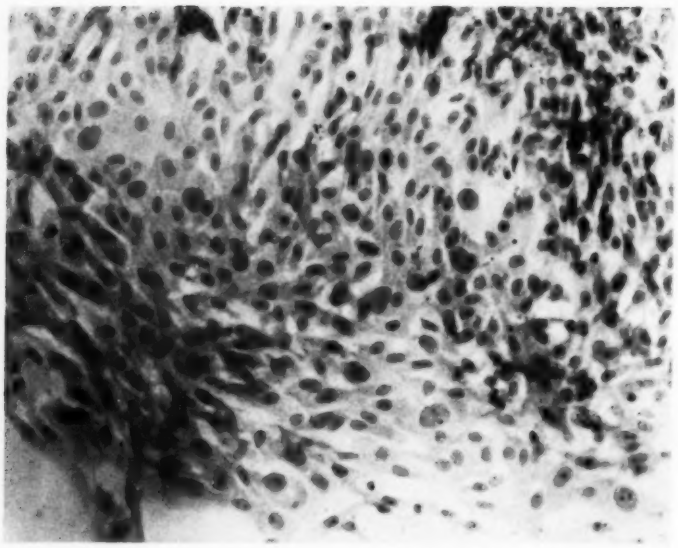


Fig. 3. Photomicrograph of a culture of an explant of the mammary tumor of the C3H strain of mice which was exposed to 100,000 r. Note the well defined intact cells, the variation in size of the nuclei, the vacuoles in the cytoplasm in some cells, and some chromatin particles. ×300

Furthermore, the new epithelial sheets were more loosely held together than in the cultures of the tumor of the C3H strain. The latter produced flat, dense sheets of epithelial cells, the nuclei of which were more distinct and tended to be oval in shape, varying somewhat in size. The nuclei of the epithelial cells of the dbrB tumor tended to be more rounded and the variation in size was greater. Figures 1 and 2 show the two tumors as they appeared in the tissue culture.

CULTURES OF IRRADIATED MAMMARY TUMOR OF THE C3H STRAIN

Explants of tumors of the C3H strain exposed to doses of from 5,000 to 15,000 r did not manifest any appreciable radiation effect. Following irradiation, new epithelial sheets were produced around the explants in twenty-four hours of incubation, gradually increasing in size. Inhibition of growth was first evident with a dose of 20,000 r. This was noticeable primarily in the latent period, only 50 per cent of the irradiated explants producing sheets of epithelium within twenty-four to forty-eight hours. The remaining 50 per cent produced growth within the next seven days, but the new growing sheets were thinner and less compact than those of control cultures. With the increase of the x-ray dose, a lengthening of the latent period and a decrease in the extent of the new growing epithelial sheets occurred. Thus, with doses of 30,000 to 40,000 r, only about 30 per cent of irradiated explants produced new growth within twenty-four to forty-eight hours. A dose of 50,000 r delayed the growth in the first two or three days of incubation, but at the fourth day, 80 per cent of the explants had begun to show new growth, and by the seventh day all showed fairly good growth. The only apparent change was the greater variation in shape and size of the nuclei, as compared to non-irradiated control cultures. With doses of 100,000 r, 60 per cent of the explants grew, while 110,000 r permitted only 25 per cent to produce new growth in seven days of incubation. The new growing cells appeared intact, with a defined nuclear membrane, but the size and shape of the nuclei showed greater variation, and occasional

vacuoles in the cytoplasm were noticed. Particles of chromatin were scattered in the field, indicating fragmentation of some nuclei. Figure 3 illustrates this condition. A dose of 130,000 r prevented the implants from producing any new growth. It is of interest to note the sudden drop in percentage of growing explants after irradiation within the range of the threshold dose. This is in accord with the observations made in the previous report (1), which dealt with implants of the same type of tumor.

CULTURES OF IRRADIATED MAMMARY TUMOR (dbrB) OF THE dba STRAIN

Explants of the tumor of the dba strain proved to be more vulnerable to radiation than those of the C3H strain. Thus, degenerative changes were already apparent in the growing cultures of explants after exposure to 20,000 r. The newly growing epithelial sheets were irregular in size and shape and a great number of cells had either broken-up or pyknotic nuclei; the nucleoli were still distinct; the cytoplasm was vacuolated. Stained cultures showed the cytoplasm to be markedly eosinophilic. Chromatin particles ("chromatin dust") were evident throughout the cultures, indicating the damage done to the nuclei by irradiation. Similar observations were made following a dose of 30,000 r, but the degenerative changes were greater (Fig. 4). A drastic decrease in the percentage of growing explants, with still greater degenerative changes, followed exposure to 40,000 and 50,000 r. Although in about 80 per cent of the cultures new sheets of epithelial cells appeared, these were loose, the majority of the cells were vacuolated, and the nuclei were either fragmented or pyknotic. In cultures of explants exposed to 60,000 and 80,000 r, loose cells occurred in the periphery of the explants instead of intact epithelial sheets. The shape and size of the cells differed markedly from those of the non-irradiated explants. In some areas only large nuclei were seen, without apparent nucleoli and without distinguishable cytoplasm (Fig. 5). A dose of 100,000 r prevented the ocurrence of any new cells in the cultures.

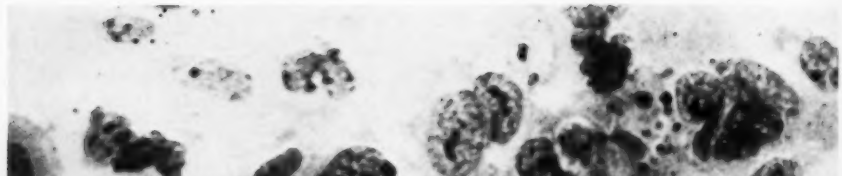
These findings are further significant evidence of the difference in radiosensitivity of two analogous mammary tumors. The present data, however, are contrary to those obtained from the previous *in vivo* experiments (1), for in tissue culture the dbrB tumor proved to be more radiosensitive than the mammary tumor of the C3H strain.

METABOLIC STUDIES

In regard to the metabolism *in vitro* of these two analogous mammary tumors, only a few pertinent facts will be reported here. A more detailed communication will be forthcoming at a later date.

The oxygen uptake, the CO_2 evolution, from which the respiratory quotients were calculated, and the aerobic glycolysis were determined. For the respiratory changes, the classical method of Barcroft-Warburg has been used, the procedure being applied as described in previous publications (4, 5). Actively growing tumors were excised under aseptic precautions, and the peripheral portions (avoiding necrotic sections) were minced with fine sharp scissors. Certain amounts were weighed on the torsion balance and placed in vessels containing 0.2 per cent glucose dissolved in phospho-Ringer solution, buffered to a *p*H of 7.4. The vessels were attached to the manometers and were placed in a water bath maintained at a constant temperature of 37.5° C. The lactic acid in the substrate was determined by the method of Friedemann, Cotonio, Shaffer, and Wendel (6).

The average of six experiments with the dbrB mammary tumor of the dba strain gave the following results, calculated on the basis of dry weight: the oxygen uptake (Q_{O_2}) was 5.6 cu. mm. per mg. tumor tissue per hour; the respiratory quotients lay between 0.8 and 0.9, and the aerobic glycolysis (Q_{O_2G}) was 25.2 gamma lactic acid per milligram tumor tissue per hour. For the mammary tumor of the C3H strain, the following average results were obtained: the oxygen uptake (Q_{O_2}) per milligram



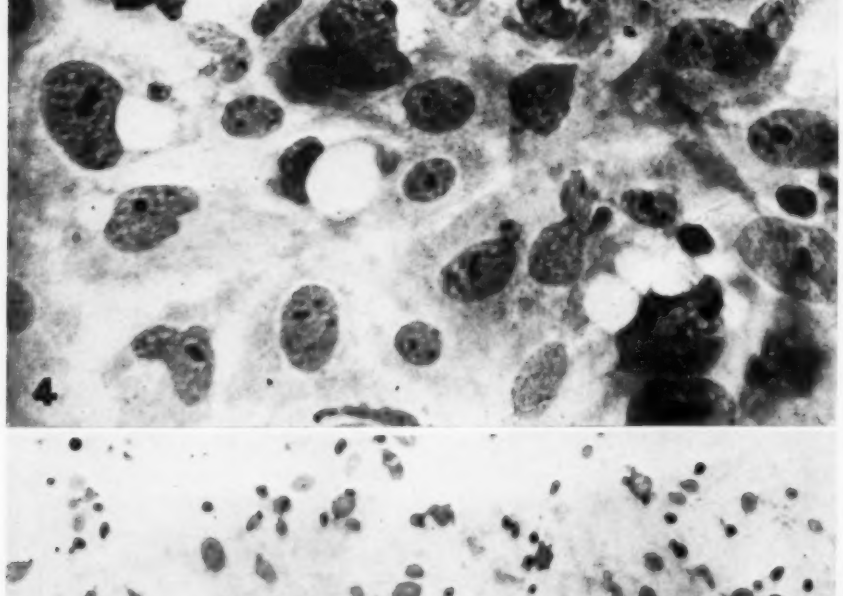


Fig. 4. Photomicrograph of a five-day culture of an explant of the mammary tumor of the dba strain, which was exposed to a dose of 30,000 r. Note the loose sheets of epithelial cells, the variation in size and shape of the nuclei, the majority of cells having vacuolated cytoplasm and broken-up nuclei. Chromatin particles are present in the field. ×1025

Fig. 5. Photomicrograph of a seven-day culture of an explant of the mammary tumor of the dba strain, which was exposed to 80,000 r. Note the thin loose cells, with round nuclei of various sizes; no nucleoli visible. The majority of cells have no apparent cytoplasm. ×340

tissue was 3.8 cu. mm. per hour; the respiratory quotients also lay between 0.8 and 0.9, and the aerobic glycolysis (O_{2QG}) was 8.6 gamma lactic acid per milligram tissue per hour. The oxygen uptake of the dbrB tumor was thus significantly higher than that of the mammary tumor of the C3H strain. A still more marked difference is to be noted in the aerobic glycolysis of the two tumors, the figure for the dbrB tumor being much higher. These data correspond to the known fact that the more rapidly growing tumor possesses a greater glycolytic activity. The average water content of the dbrB tumor was about 86 per cent, while that of the tumor of the C3H strain was about 82 per cent. This is also in agreement with the established fact that more rapidly growing tissues possess a greater water content.

These results give further evidence that the physiological characteristics are of greater fundamental importance than purely morphological structures in distinguishing between tumors.

DISCUSSION

Evidence was submitted in a previous publication (1) that two analogous mammary tumors differed widely in their radiosensitivity when implanted *in vivo*. Thus, the mammary tumor of the C3H strain planted *in vivo*, following irradiation *in vitro*, proved to be more radiosensitive than that of the dba strain. The present report records significant findings indicating that the differential radiosensitivities of these two tumors are reversed when they are cultivated *in vitro*. From the results of the tissue culture experiments, it may be definitely concluded that the tumor of the dba strain is more radiosensitive than the tumor of the C3H strain. The question arises, then, as to why a tumor which, from the evidence of tissue culture, is more radiosensitive proves, when implanted *in vivo*, to be more radioresistant. To answer this question, one may speculate as follows: It is well known that the establishment of growth of a tumor implant in the animal host depends upon the ability of the tumor to elicit an adequate vascular supply; in tissue culture, on the other hand, the nutritive supply is already present. One may assume that the mechanism of the mammary tumor of the C3H strain to elicit vascular supply is more readily impaired by radiation than that of the dbrB tumor. The cells of the two tumors may appear to be morphologically similar; their physiological response to radiation, however, shows them to be quite different, depending upon whether they are in conjunction with the host of origin or are apart from it.

The great difference in dosage required to produce the same effect *in vivo* in contrast to that required *in vitro* was demonstrated in a previous experiment (7). The data obtained from the present study with the two analogous tumors are surprising from the point of view that the more rapidly growing tumor proved to be more radiosensitive *in vitro* than *in vivo*. In the first situation, this is in agreement with the concept that rapidly growing tumors are more radiosensitive and is in accord with the law of Bergonié and Tribondeau (8), which postulates that "the strongest effect of radiation is exerted on the least differentiated cells and on those of greatest reproductive ability." The results *in vivo*, however, are contrary to this concept, since the more rapidly growing tumor required a larger dose than the slower growing tumor. Clinical observations indicate that the rapidly growing anaplastic tumors, although regarded as radiosensitive, tend to be incurable. Consequently, it may be said that the Bergonié and Tribondeau law does not apply where complete destruction of the tumor is concerned. The dbrB tumor grown *in vivo* serves as another example.

Further, whether the radiosensitivity of these two tumors, which differs *in vivo* and *in vitro*, is dependent upon their ability to recover following given doses of radiation is still an open question. Additional studies may throw some light on this problem. This point was more elaborately discussed in the previous report (1).

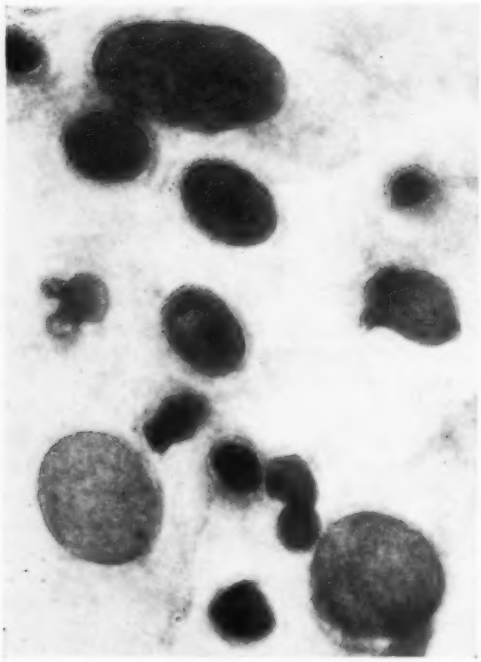


Fig. 6. Photomicrograph (phase optics) of the same culture as Fig. 5. Note the loose, large, round nuclei, some slightly oval; no apparent nucleoli. In some cells, part of the cytoplasm is slightly visible; in some cells not at all. ×1000

Another possibility lies in the fact that radiation can promote differentiation, although abnormally, and produce a type or types of cells of a different physiological make-up. It is known that chromosomal changes induced in cells by radiation may lead either to death or production of a new cell type. In support of this statement, reference is made to Figures 6, 7, and 8. Figure 6 (high magnification with phase optics), which represents a culture of the dbrB tumor following irradiation with 80,000 r, shows large nuclei with no visible nucleoli, cytoplasm scarcely apparent in some and broken up in other instances. Figure 7 (also high magnification with phase optics), which represents a culture of the mammary tumor of the C3H strain exposed to 100,000 r, shows, in contrast, intact cells with defined nuclei and nucleoli and distinct cytoplasm. On the other hand, Figure 8 represents a giant cell containing about 10 nuclei, which occurred in a culture of the tumor of the C3H strain which was exposed to 10,000 r. It may be interpreted that this type of tumor has a tendency to produce multinucleated giant cells following a given dose of radiation, which in no instance was noted in cultures of the dbrB tumor.

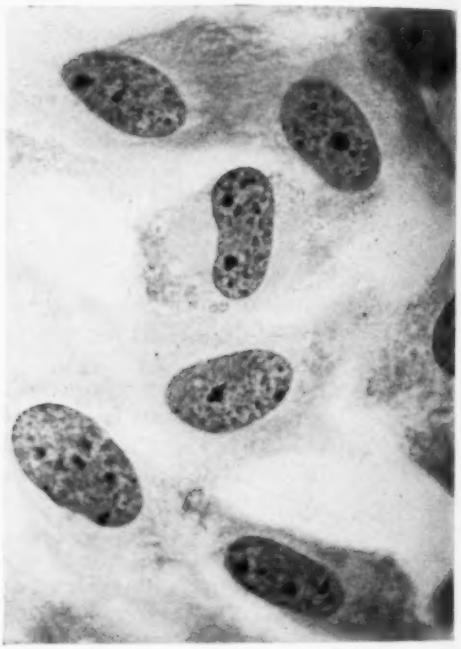


Fig. 7. Photomicrograph (phase optics) of same culture as Fig. 3. Note intact epithelial cells, with distinct nucleoli and cytoplasm (in contrast to Fig. 6). ×1000

From the data obtained in this study, evidence is brought forth that intrinsic properties, unobscured by the influence of the host, can be revealed by the tissue culture technic. A correlation of results obtained from both *in vitro* and *in vivo* experiments, using a standard technic, may lead to a better understanding of radiosensitivity of tumors and consequently may help to determine the therapeutic dosage.

SUMMARY

The growth characteristics in tissue culture of two analogous mammary mouse tumors, both diagnosed as adenocarcinoma,

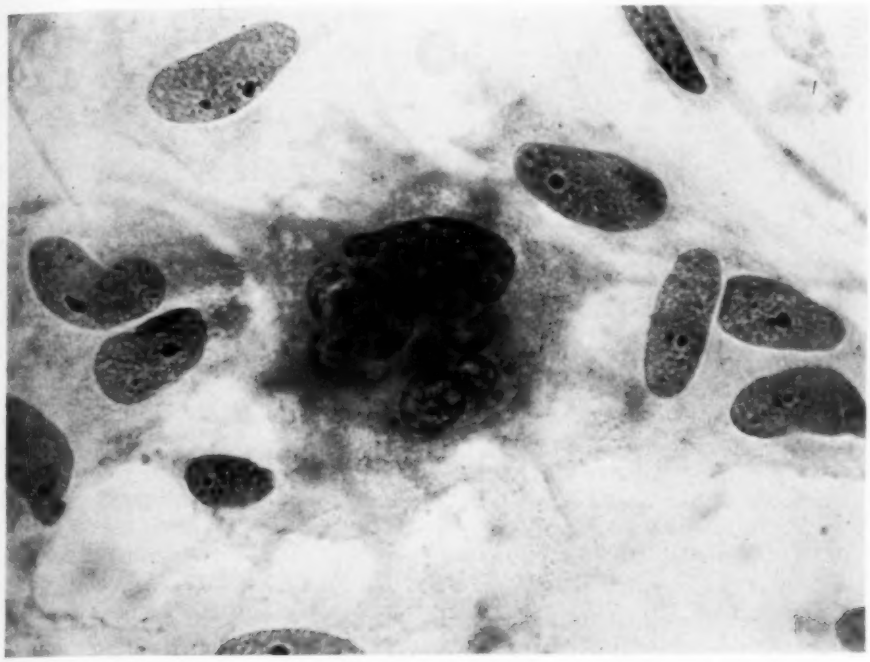


Fig. 8. Photomicrograph of culture of explant of tumor of C3H strain exposed to 10,000 r. Note giant cell with about 10 nuclei; distinct nucleoli and distinct cytoplasm. ×800

irradiated and non-irradiated, are described. Both tumors originated in inbred strains of mice, C3H and dba. A great difference was found between the radiosensitivities of these analogous tumors. Thus, the slower growing tumor of the C3H strain proved to be more radioresistant when grown *in vitro* than the faster growing one of the dba strain. This is contrary to previous observations *in vivo*, which showed the tumor of the dba strain to be the more radioresistant. Some explanation for the mechanisms governing growth *in vitro* and *in vivo* are offered.

The mammary tumor of the dba strain exhibited a greater glycolytic activity than the mammary tumor of the C3H strain. This corresponds to the fact that faster growing tissues possess a greater glycolytic activity, as the dba is the faster growing tumor of the two. It is concluded that intrinsic qualities unobscured by the host can be revealed in *in vitro* studies. The correlation of results obtained from *in vivo* and *in vitro* experiments may lead to a better understanding of radiosensitivity of tumors, and consequently to a better evaluation of therapeutic dosage.

NOTE: Acknowledgment is made to Carl B. Braestrup, senior physicist of the Department of Hospitals, New York City, and his associates, for supplying the physical measurements; to Dr. Ira I. Kaplan, Director of the Radiation Therapy Department, Bellevue Hospital, for permission to use the x-ray equipment; to the Misses Clara Serber and Beatrice Carl for administering the x-ray treatments, and to Annabelle Goldberg for cooperation in the metabolism studies.

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SUMARIO

Nuevos Estudios de la Radiosensibilidad de los Tumores Autógenos en Huespedes Homócigos

Descríbense las características del crecimiento en cultivos histológicos de dos tumores mamarios análogos de murino, ambos diagnosticados como adenocarcinoma, irradiados y no irradiados. Ambos tuvieron su origen en cepas entrecruzadas de ratones: C_3H y dba. Observóse una gran diferencia entre la radiosensibilidad de esos dos tumores análogos. Por ej., el tumor mamario de la cepa C3H resultó, al ser cultivado *in vitro*, más radiorresistente que el de la cepa dba, lo cual choca con las observaciones realizadas en previos experimentos *in vivo*, en los que el tumor de la cepa dba se mostró más radiorresistente.

Para explicar dicha diferencia, señálase que el establecimiento del crecimiento *in vivo* depende de la capacidad para evocar un riego sanguíneo adecuado, indicándose que ese mechanismo puede afectarse más fácilmente en lo que respecta al tumor C3H que al tumor de la cepa dba. Indícase además que la diferencia en la reacción de los dos tumores puede guardar relación con su diferente capacidad para reponerse después de una dosis dada de irradiación, lo cual dependerá de si el cultivo es *in vivo* o *in vitro* y con el hecho de que la irradiación puede fomentar la diferenciación anómala de las células y producir así un tipo o tipos de células de diversa constitución fisiológica.

El tumor mamario de la cepa dba manifestó mayor actividad glucolítica que el de la cepa dba, lo cual armoniza con el hecho de que los tejidos de desarrollo más rápido poseen mayor actividad glucolítica, pues el dba es el tumor que se desarrolla más rápidamente. Dedúcese que en los estudios *in vitro* pueden revelarse ciertas cualidades intrínsecas sin que las oscurezca el huésped. La correlación de los resultados obtenidos en los experimentos ejecutados *in vivo* e *in vitro* puede conducir a una comprensión mejor de la radiosensibilidad de los tumores, y por consiguiente a una justipreciación mejor de la dosis terapéutica.

Absorption of X-Rays in Air[1]

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THE USE, IN RECENT years, of beryllium-window x-ray tubes with their high-intensity output of soft x-rays has produced a need for air-absorption corrections where distance is a factor in x-ray exposure measurements. Such is the case, for example, where the inverse-square law is utilized for computing the exposure at a point when the actual measurement is of necessity made at some other point. There is also need for corrections to be applied to the free-air type of ionization chamber due to air absorption between the limiting diaphragm of the chamber and the front edge of the collector plates. Since the exposure rate is specified in the plane of the limiting diaphragm, air-absorption along the path between the diaphragm and the collector plate results in the readings of the chamber being too low. This distance in the case of the guarded-field free-air standard for calibrations up to 200 kv. at the Bureau of Standards is 21.1 cm., and for unfiltered radiations produced at, say, 50 kv. considerable corrections may be necessary.

APPARATUS AND EXPERIMENTAL PROCEDURE

A diagram of the experimental arrangement is shown in Figure 1, where a mobile, free-air, guard-plate ionization chamber is indicated. The opening in its lead shield is 10 cm. in diameter. This opening is adequate to accommodate, at any point along the track, the total area of x-rays determined by the fixed, limiting diaphragm, the diameter of which is 1.75 cm. The effective width of the collector plates is 10.2 cm., and the diameter of the beam with the chamber in its farthest position from the tube (Position B, Fig. 1) is 6.5 cm. The inter-electrode separation is a fixed distance of 12.7 cm., and this is insufficient spacing to allow for the production and collection of all secondary electrons associated with a primary beam 6.5 cm. in diameter. Hence, there is a slight loss of ionization, which earlier studies show does not exceed 1 or 2 per cent (1).

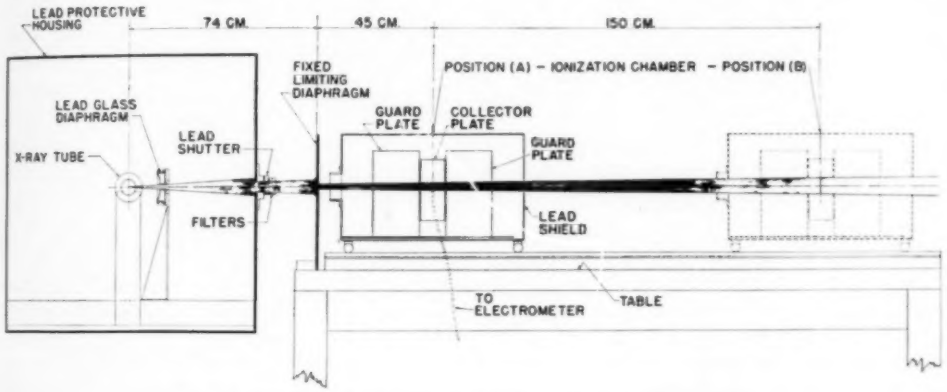

Fig. 1. Experimental arrangement for air-absorption measurements.

The charge collected in the ionization chamber at various points along the track is measured with a capacity compensator and string electrometer (2) with an ac-

[1] Read by title at the Thirty-third Annual Meeting of the Radiological Society of North America, Boston, Mass., Nov. 30-Dec. 5, 1947.

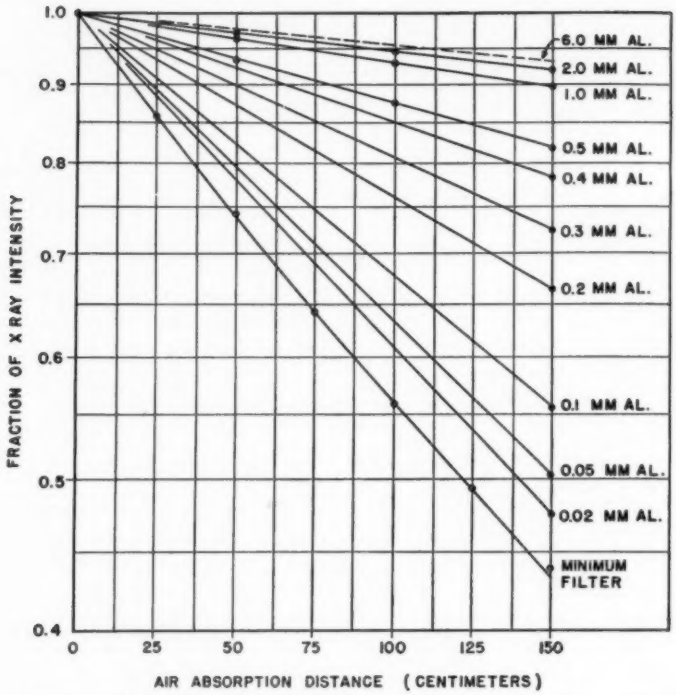

Fig. 2. Effect of aluminum filtration on air absorption of 50-kv. x-rays produced by beryllium-window x-ray tube with inherent filtration 1.5 mm. beryllium.

curacy of ±1.0 per cent. The exposure of the chamber is controlled by a timer operating a one-half-inch lead shutter. The timer is actuated by an accurately controlled 60-cycle signal from the Radio Section of the Bureau of Standards.

Tungsten-target x-ray tubes with low inherent filtration are used in conjunction with various types and thicknesses of initial filtration. The term "initial filtration," as here used, refers to filters of aluminum, copper, or lead introduced between the x-ray tube and the column of air over which air-absorption measurements are made. The window thickness of the cerium glass in one tube used is 1.29 mm., and of the beryllium in another, 1.5 mm.

Power supplied to the x-ray tube is furnished by a kenotron rectifier with a resistance-capacitance filter incorporated to reduce the ripple to 0.05 per cent per milliampere current drain. The tube currents used are not in excess of 10 ma.

The voltage input to the rectifier units is constant to 0.25 per cent or better, the 208-volt commercial supply being fed through a voltage stabilizer. The voltage to the rectifier units is then varied by induction regulator control. It is estimated that the absolute d.-c. voltage applied to the x-ray tubes is known to an accuracy of 1.0 or 2.0 per cent. The filament voltage of the x-ray tubes is stabilized by an electronic voltage stabilizer in the ground circuit feeding through an insulating transformer. The output of the stabilizer is also manually controlled by an adjustable-ratio autotransformer to reduce long-period fluctuations.

In view of the above described stabilization, the variation in quantity of x-ray output over a period of exposure of ten seconds or more is not greater than 0.5 per cent. This is also verified from previous experience on fluctuations in x-ray output of this equipment, as determined by the

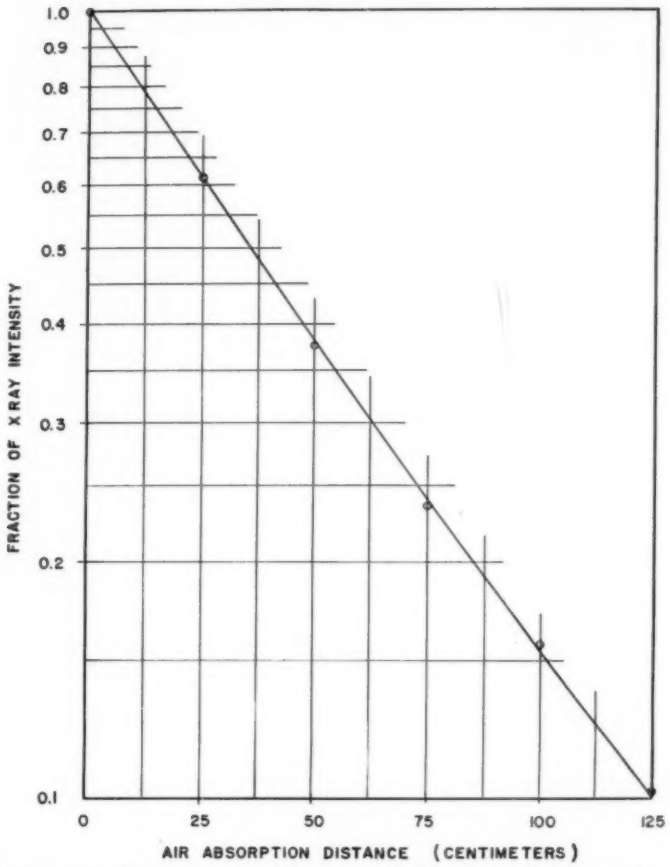

Fig. 3. Air absorption of 7.5-kv. x-rays produced by beryllium-window tube with inherent filtration 1.5 mm. beryllium.

Bureau's standard chamber for measurements up to 200 kv.

OBSERVATIONS AND CALCULATIONS

Under steady operating conditions of the x-ray tube, the ionization chamber is exposed for a given number of milliampere-seconds at successive points along the track. The ratio of the ionization currents measured at two points along the track is a measure of the air absorption between these points, inasmuch as the total flux passing through the limiting diaphragm is measured by the chamber, except for the part lost by air absorption.

Measurements are first made, using the beam in its minimum-filter condition. Filters of aluminum, copper, or lead are then interposed in the beam up to the point where the beam is rendered sufficiently homogeneous so that further additions of filters will not lower the air-absorption coefficient by an appreciable amount. This is illustrated (Fig. 2) by the semilogarithmic plots of x-ray intensity as a function of the length of the absorbing air path for 50-kv. x-rays from the beryllium-window tube. Here it is observed that filtrations in excess of 2 mm. of aluminum will not greatly affect the air absorption.[2] Simi-

[2] The curve for 6-mm. filtration was not observed at this voltage because of the extremely long exposure which would be necessary. At 100 kv., however, the difference between the 2-mm. and the 6-mm. curves is approximately 1.0 per cent. The difference would not be greater than this in the case of 50-kv. x-rays, for the same amount of filter would render the beam more homogeneous in the latter case.

TABLE I: LINEAR ABSORPTION COEFFICIENTS (μ) FOR X-RAYS OF AIR UNDER ATMOSPHERIC CONDITIONS, USING BERYLLIUM-WINDOW X-RAY TUBE

Voltage (kv.)	Minimum Filtration* ($cm.^{-1}$)	Added Filtration			
		0.05 mm. Cu ($cm.^{-1}$)	0.1 mm. Cu ($cm.^{-1}$)	0.2 mm. Cu ($cm.^{-1}$)	0.1 mm. Pb ($cm.^{-1}$)
50	5.8×10^{-3}	3.5×10^{-3}	1.5×10^{-3}	0.5×10^{-3}	0.3×10^{-3}
60	5.6×10^{-3}	3.1×10^{-3}	1.2×10^{-3}	0.4×10^{-3}	0.3×10^{-3}
70	5.5×10^{-3}	2.8×10^{-3}	1.1×10^{-3}	0.4×10^{-3}	0.3×10^{-3}
80	5.3×10^{-3}	2.5×10^{-3}	1.0×10^{-3}	0.4×10^{-3}	0.3×10^{-3}
90	5.2×10^{-3}	2.2×10^{-3}	0.9×10^{-3}	0.3×10^{-3}	0.3×10^{-3}
100	5.1×10^{-3}	2.0×10^{-3}	0.8×10^{-3}	0.3×10^{-3}	0.3×10^{-3}
120	4.8×10^{-3}	1.6×10^{-3}	0.7×10^{-3}	0.3×10^{-3}	0.3×10^{-3}
140	4.6×10^{-3}	1.3×10^{-3}	0.6×10^{-3}	0.3×10^{-3}	0.3×10^{-3}
160	4.3×10^{-3}	1.1×10^{-3}	0.5×10^{-3}	0.3×10^{-3}	0.3×10^{-3}
180	4.1×10^{-3}	1.0×10^{-3}	0.5×10^{-3}	0.3×10^{-3}	0.3×10^{-3}
200	3.9×10^{-3}	0.8×10^{-3}	0.4×10^{-3}	0.3×10^{-3}	0.3×10^{-3}

* Minimum filtration is 1.5 mm. of beryllium plus 119 cm. of air.

TABLE II: LINEAR ABSORPTION COEFFICIENTS (μ) FOR X-RAYS OF AIR UNDER ATMOSPHERIC CONDITIONS, USING BERYLLIUM-WINDOW X-RAY TUBE

Voltage (kv.)	Minimum Filtration* ($cm.^{-1}$)	Added Filtration						
		0.05 mm. Al ($cm.^{-1}$)	0.2 mm. Al ($cm.^{-1}$)	0.5 mm. Al ($cm.^{-1}$)	1.0 mm. Al ($cm.^{-1}$)	2.0 mm. Al ($cm.^{-1}$)	4.0 mm. Al ($cm.^{-1}$)	6.0 mm. Al ($cm.^{-1}$)
7.5	20.5×10^{-3}							
10	12.9×10^{-3}	9.7×10^{-3}	8.3×10^{-3}					
15	7.8×10^{-3}	.....	.....					
20	6.9×10^{-3}	5.3×10^{-3}	3.9×10^{-3}	2.5×10^{-3}				
30	6.1×10^{-3}	4.9×10^{-3}	3.3×10^{-3}	1.8×10^{-3}	0.9×10^{-3}	0.8×10^{-3}		
40	5.9×10^{-3}	4.8×10^{-3}	3.0×10^{-3}	1.5×10^{-3}	0.8×10^{-3}	0.6×10^{-3}		
50	5.8×10^{-3}	4.6×10^{-3}	2.8×10^{-3}	1.4×10^{-3}	0.7×10^{-3}	0.6×10^{-3}	0.5×10^{-3}	0.4×10^{-3}
60	5.6×10^{-3}	4.5×10^{-3}	2.7×10^{-3}	1.3×10^{-3}	0.7×10^{-3}	0.6×10^{-3}	0.5×10^{-3}	0.4×10^{-3}
70	5.5×10^{-3}	4.4×10^{-3}	2.6×10^{-3}	1.2×10^{-3}	0.7×10^{-3}	0.5×10^{-3}	0.5×10^{-3}	0.4×10^{-3}
80	5.3×10^{-3}	4.3×10^{-3}	2.5×10^{-3}	1.1×10^{-3}	0.6×10^{-3}	0.5×10^{-3}	0.5×10^{-3}	0.4×10^{-3}
90	5.2×10^{-3}	4.2×10^{-3}	2.4×10^{-3}	1.0×10^{-3}	0.6×10^{-3}	0.5×10^{-3}	0.4×10^{-3}	0.4×10^{-3}
100	5.1×10^{-3}	4.1×10^{-3}	2.3×10^{-3}	0.9×10^{-3}	0.6×10^{-3}	0.5×10^{-3}	0.4×10^{-3}	0.4×10^{-3}

* Minimum filtration is 1.5 mm. of beryllium plus 119 cm. of air.

TABLE III: LINEAR ABSORPTION COEFFICIENTS (μ) FOR X-RAYS OF AIR UNDER ATMOSPHERIC CONDITIONS USING CERIUM-GLASS-WINDOW X-RAY TUBE

Voltage (kv.)	Minimum Filtration* ($cm.^{-1}$)	Added Filtration				
		0.5 mm. Al ($cm.^{-1}$)	1.0 mm. Al ($cm.^{-1}$)	2.0 mm. Al ($cm.^{-1}$)	4.0 mm. Al ($cm.^{-1}$)	6.0 mm. Al ($cm.^{-1}$)
20	3.2×10^{-3}					
30	2.6×10^{-3}	1.3×10^{-3}	0.9×10^{-3}	0.8×10^{-3}		
40	2.2×10^{-3}	1.1×10^{-3}	0.8×10^{-3}	0.6×10^{-3}		
50	2.1×10^{-3}	1.0×10^{-3}	0.7×10^{-3}	0.6×10^{-3}	0.5×10^{-3}	0.4×10^{-3}
60	2.0×10^{-3}	0.9×10^{-3}	0.7×10^{-3}	0.6×10^{-3}	0.5×10^{-3}	0.4×10^{-3}
70	1.9×10^{-3}	0.9×10^{-3}	0.7×10^{-3}	0.5×10^{-3}	0.5×10^{-3}	0.4×10^{-3}
80	1.8×10^{-3}	0.8×10^{-3}	0.6×10^{-3}	0.5×10^{-3}	0.5×10^{-3}	0.4×10^{-3}
90	1.8×10^{-3}	0.8×10^{-3}	0.6×10^{-3}	0.5×10^{-3}	0.4×10^{-3}	0.4×10^{-3}
100	1.7×10^{-3}	0.7×10^{-3}	0.6×10^{-3}	0.5×10^{-3}	0.4×10^{-3}	0.4×10^{-3}
110	1.6×10^{-3}	0.7×10^{-3}	0.6×10^{-3}	0.5×10^{-3}	0.4×10^{-3}	0.4×10^{-3}
120	1.5×10^{-3}	0.7×10^{-3}	0.6×10^{-3}	0.5×10^{-3}	0.4×10^{-3}	0.4×10^{-3}

* Minimum filtration is 1.29 mm. of cerium glass plus 119 cm. of air.

larly, it is found that for any voltage up to 200 kv., filtrations of 6 mm. of Al, 0.2 mm. of Cu, or 0.1 mm. of Pb are sufficient for the attainment of a practical lower limit to the air absorption.

These studies are made with x-rays of 200 kv. and less, to voltages as low as transmission through filters will allow. Minimum-filter conditions permit observations on x-rays as low as 7.5 kv. from a

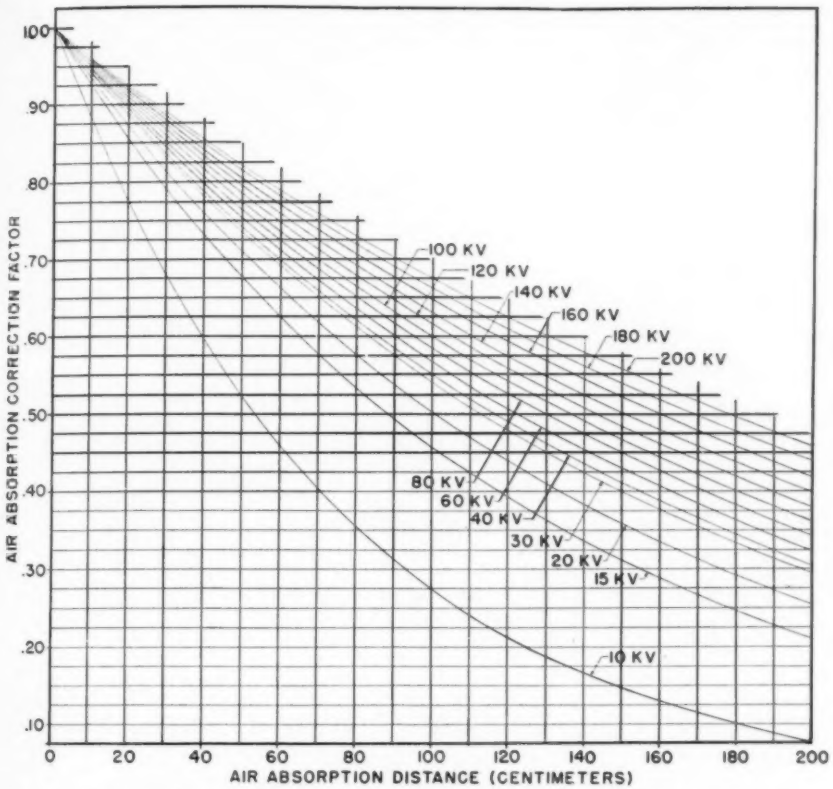

Fig. 4. Air absorption reduction in intensity of minimum-filter x-ray beam from beryllium-window tube with inherent filtration 1.5 mm. beryllium.

beryllium-window tube. Even these 7.5-kv. x-rays show no great change in quality due to absorption in the air itself over the distance of observation, as indicated by a near straight-line semilogarithmic plot in Figure 3. Since the beam is effectively monochromatic, it is permissible to prepare tables of linear absorption coefficients involving a single term[3] for air under normal atmospheric conditions (760 mm. of mercury pressure and 22° C.), these to be applied over short distances.

Tables I, II, and III give effective linear absorption coefficients, μ (cm.$^{-1}$) for air, where μ is used in the formula, $I_X = I_o e^{-\mu x}$, I_X being the intensity at a distance X cm. beyond the point where the original intensity, I_o, is measured. The x-ray beam is here considered to be parallel.

Data in these tables are derived by calculating μ for air between 119 cm. and 269 cm. from the tube target. Errors due to change in quality of the x-rays will be involved in applying these data to determine intensities at great distances[4] from the target and also at distances a few centimeters from the target. However, within the range of approximately 1 to 3 meters from the target, these coefficients may be applied with little error.

For ready reference, some air-absorption correction factors have been prepared and

[3] To specify accurately the absorption of a heterogeneous beam, it is necessary to employ an expression which is the sum of exponential terms involving different absorption coefficients.

[4] "Great distances," as here used, refers to the absorption by a sufficient quantity of air to reduce the intensity of the original beam by several half-value layers. However, reductions of the order of only *one* half-value layer, such as observed in this experiment (see Fig. 2), show very little quality dependence.

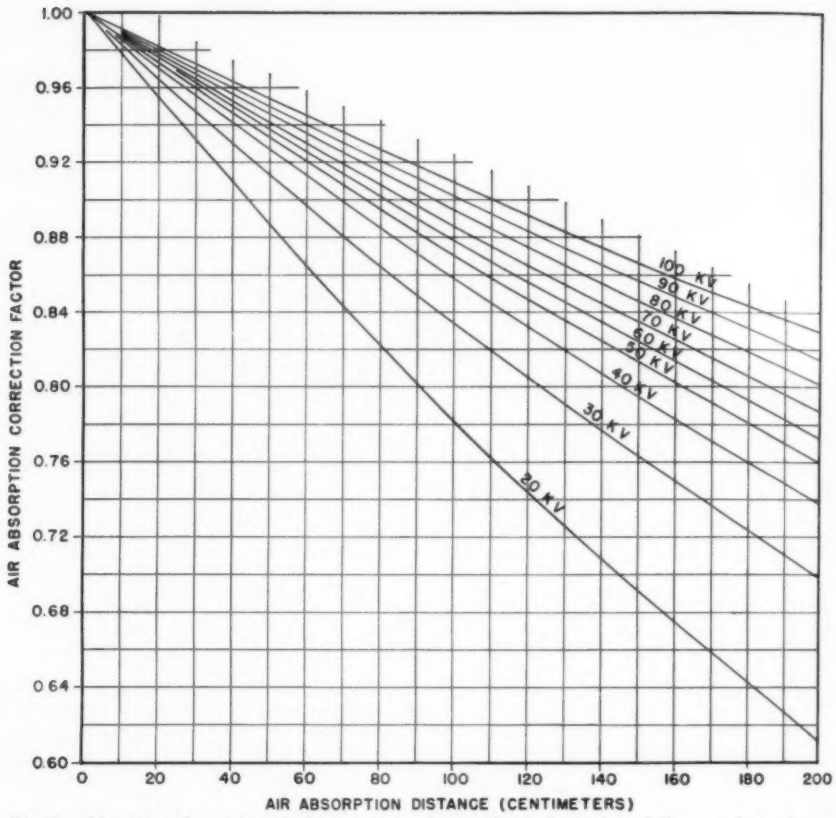

Fig. 5. Air-absorption reduction in intensity of x-ray beam filtered by 0.5 mm. of aluminum (inherent filtration of x-ray tube used 1.5 mm. beryllium).

are shown in Figures 4, 5, 6, and 7. For a parallel beam, the air-absorption correction factor, C, is taken to be,

$$C = \frac{I_x}{I_o}$$

In the case of a diverging beam, it may be defined as,

$$C = \frac{I'_x}{I'_o}\left(\frac{X_o + X}{X_o}\right)^2$$

where I'_o and I'_x are the intensities measured by r-meter (3) at distances X_o and $X + X_o$ cm., respectively, from the tube target.

The correction factor, C, may be used in calculating intensities at various points, where a thimble-chamber (3) measurement is made at one point only. Its application in field use is to determine the intensity at one position by air ionization measurement, calculate by inverse-square law the intensity to be expected at some distance farther from the source, if it were operating alone as a reducing factor; then, multiply this intensity by the air-absorption correction factor to determine the true intensity. If the intensity is to be determined at some point closer to the source than the ionization measurement is made, the reciprocal of the air-absorption correction factor will be used as the multiplying factor.

In cases where the graphs do not cover the conditions desired, the air absorption correction factor may be calculated, using the absorption coefficients given in Tables I, II, and III, and the equation, $C = e^{-\mu x}$. As an example of this calculation, Table III indicates that μ for 40 kv. with 1.0 mm.

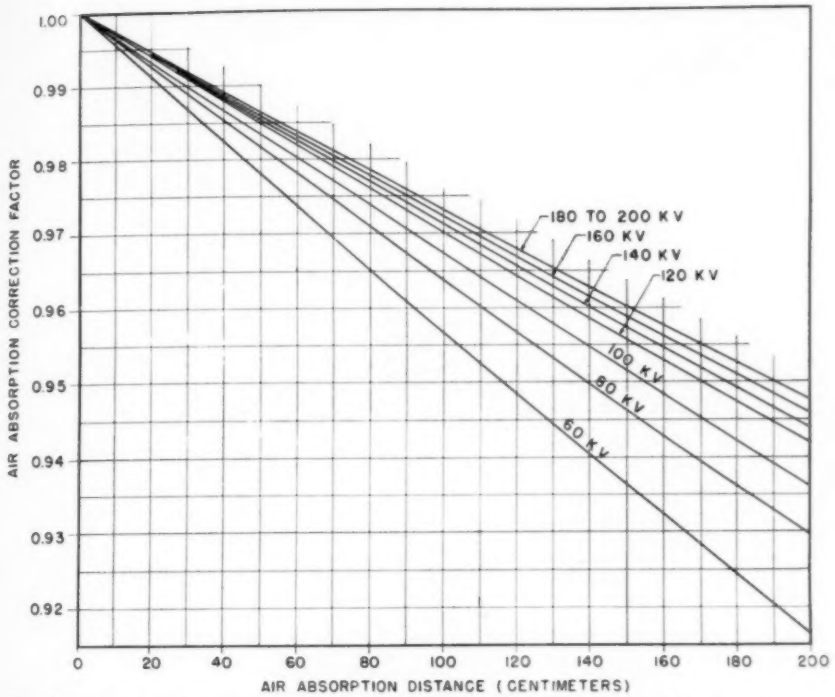

Fig. 6. Air absorption reduction in intensity of x-ray beam filtered by 0.2 mm. of copper (inherent filtration of x-ray tube used 1.5 mm. beryllium).

Al of added filtration is 0.8×10^{-3} cm.$^{-1}$. C is then defined for arbitrary values of X beyond 119 cm. from the tube target. It is convenient to arrange the work in tabular form, as follows:

X	μX	$e^{-\mu X}$
25 cm.	0.02	0.08
50 cm.	0.04	0.96
100 cm.	0.08	0.92
150 cm.	0.12	0.89
200 cm.	0.16	0.85

FREE-AIR CHAMBER VERSUS THIMBLE-CHAMBER AIR-ABSORPTION DATA

That the air absorption factors determined with the free-air chamber are applicable also to thimble chamber use is indicated by reference to Table IV. In this case, the limiting diaphragm is removed and a 25-r thimble chamber is placed at the mid-point of the collector plates of the free-air chamber, the latter chamber being here used only as a vehicle for transport of the thimble chamber.

TABLE IV: COMPARISON OF AIR ABSORPTION DATA FOR 90-KV. X-RAYS OBTAINED BY THIMBLE IONIZATION CHAMBER WITH THOSE OBTAINED BY FREE-AIR IONIZATION CHAMBER UNDER MINIMUM-FILTER CONDITION (1.29 MM. OF CERIUM GLASS)

Distance ("X") of Air Absorption* (cm.)	Intensity, as Measured by Thimble Chamber† (per cent)	Thimble Chamber Intensity Calculated to Indicate Air Absorption Only‡ (per cent)	Intensity as Measured by Free-air Chamber (per cent)
0	100	100	100
25	64.9	95.1	94.9
50	44.9	90.7	91.0
75	32.5	86.4	87.0
100	24.5	83.1	83.1
125	18.9	79.4	80.3
150	15.0	76.7	77.7

* "X" is the ionization chamber travel distance, the zero position of which being 119 cm. from the x-ray tube target.

† This includes inverse-square reduction in intensity superimposed upon air absorption reduction.

‡ The observed thimble chamber intensity times $((119 + X)/119)^2$ yields an intensity indicating the air absorption reduction only.

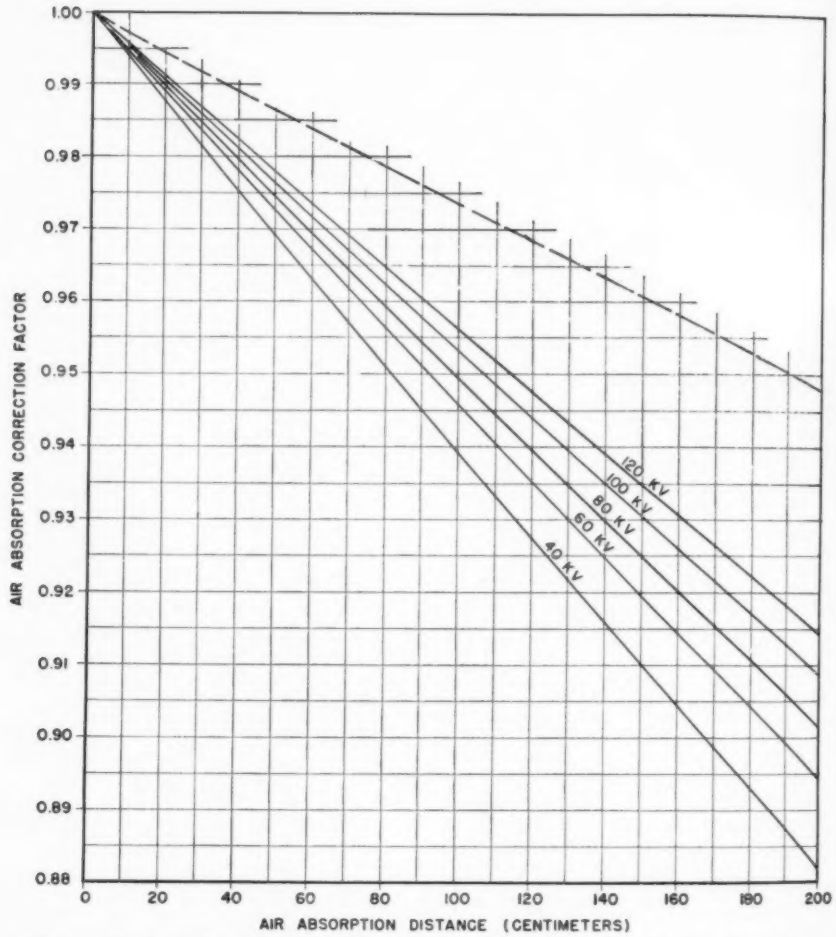

Fig. 7. Air-absorption reduction in intensity of x-ray beam filtered by 2.0 mm. of aluminum (solid lines). Dashed line indicates reduction produced by 0.1 mm. of lead filter for x-rays of all qualities from 50 kv. to 200 kv. (Inherent filtration of x-ray tube used is 1.5 mm. beryllium.)

Data obtained are at 90 kv. with no filtration other than 1.29 mm. of cerium glass, the tube window thickness.

These data show reductions in intensity due both to the inverse-square law and to air absorption. The minimum target-to-thimble chamber distance used is 119 cm. Multiplication of the thimble chamber readings by $((119 + X)/119)^2$, where X is the thimble chamber travel distance, yields data indicating air absorption only. The data obtained in this manner with the thimble chamber agree within 1 per cent with those using the free-air chamber as described above under "Observations and Calculations."

In the case of soft x-rays, thimble chamber measurement of the *ratio* of intensities between two points may be made without appreciable error because there is no significant selective absorption of the soft components of the x-rays in traversing the amounts of air considered. The *calibration* of thimble chambers for soft x-rays, however, will be in error, the readings being less than those for hard x-rays because there is appreciable absorption of the soft rays in the thimble chamber wall. The

subject of such calibrations for soft x-rays will be discussed in another paper now in preparation.

NOTE: We wish to acknowledge the assistance of Mr. John H. Baltrukonis in obtaining much of the data reported above.

National Bureau of Standards
Washington, D. C.

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SUMARIO

Absorción de los Rayos X en el Aire

El empleo de los tubos de rayos X con ventanas de berilio, con su intensísima producción de rayos X blandos, ha creado la necesidad de hacer correcciones con respecto a la absorción en el aire siempre que la distancia constituya un factor en las mediciones de la exposición a los rayos X. También hay que aplicar correcciones a la cámara de yonización al aire libre debido a la absorción en el aire entre el diafragma limitativo de la cámara y el borde frontal de las placas colectoras.

El texto y el grabado (Fig. 1) describen un sistema experimental para medir la absorción en el aire, habiéndose obtenido con el mismo factores de corrección en varias circumstancias y para una escala de voltajes, según revelan las gráficas adjuntas. También se ofrecen tablas que revelan los coeficientes de absorción para empleo al calcular los factores de corrección en condiciones no abarcadas por las gráficas.

Los factores de absorción en el aire, determinados con una cámara de yonización al aire libre, también resultaron aplicables a las cámaras de dedal.

Role of the Roentgenologist in a Proposed Plan for Small Film Screening of the Inhabitants of Major Cities[1]

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IN TUBERCULOSIS control, as in any public health procedure, it is essential that cases be discovered early and that persons with the disease be prevented from spreading it to others. This is especially true for tuberculosis, as we have no universally accepted immunizing agent for the disease.

The importance of the early diagnosis of tuberculosis cannot be overemphasized. A case discovered in the minimal stage is amenable to treatment and stands an excellent chance of complete recovery. Furthermore, a case discovered in this stage will, in the vast majority of instances, be non-infectious to the public. Granted, then, that we must discover the disease early, the question naturally arises as to how this may be accomplished. Until recent years we had no good answer to this question. Fortunately, however, a new tool has been discovered within the past decade with which it is possible to attain our goal. I am referring, of course, to the development of small-film photofluorography, that is, 35-mm., 70-mm., and 4 × 5-inch microfilm units. Tremendous advances have been and are still being made in this field.

Due to the development of small-film x-ray units, we are in a position to take chest films of large segments of the population for screening purposes. We are today afforded unequaled opportunities to accomplish our aim of tuberculosis control, or even eradication, if we employ with vigor the methods of attack now at our command. The principal problem in our case-finding program today is that of getting people to the x-ray units for examination.

The public, already fairly well educated about tuberculosis, must be continuously stimulated to action. A recent Gallup poll showed that 70 per cent of those interviewed thought tuberculosis was "catching"; 83 per cent felt that a person who has tuberculosis gets well. This is indeed encouraging to those who have worked so hard to get these facts to the people. A broad program of control based on sound principles will be effective only in proportion to its public acceptance and support. The ubiquity of tuberculosis and the magnitude of its harmful effects on the health and happiness of the American people are at last arousing public consciousness and stimulating nation-wide action. When the people demand a total assault on tuberculosis, we must be prepared to measure the problems, plan the offensive, and defeat the tubercle bacillus in a measurable period of time.

The experience of the Tuberculosis Control Division since its inception in 1944 has taught us many things about the control of this disease. Starting with special occupational and racial groups, the Division learned a great deal concerning the nature, occurrence, and lethality of tuberculosis. At the same time, however, it found that our present procedure was too deliberate an attack upon a disease which is widespread and will not wait upon methods that are sound but slow.

To control the spread of tuberculosis it is necessary that each year a smaller number of cases result from a given number of open, active cases. This will break the line of succession of tuberculosis without requiring an appreciable change in the resistance or environment of the individual.

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[1] Presented at the Thirty-third Annual Meeting of the Radiological Society of North America, Boston, Mass., Nov. 30–Dec. 5, 1947.

The continuing decrease of exposure and the decrease in number of new open cases would terminate in the selective mortality of the tubercle bacillus. However, the rate at which this occurs is related directly to the speed, extent, and continuity of the control program. There must be a time plan for the control of tuberculosis. It has been estimated that, if we find the major sources of infection within a five-year period, we can realistically hope to win the fight against the tubercle bacillus.

Within the past two years millions of people throughout the world have been examined for tuberculosis by microfilm methods. In one year of operation, the U. S. Public Health Service alone surveyed over 1,000,000 people. If every community in the country, within the next five years, makes every possible effort to advance the case-finding program, the complete and exact picture of tuberculosis in the United States can be obtained. This means that every community must organize and take an active part in the movement, utilizing all equipment, professional medical personnel, community leaders, publicity leaders, and other resources. Not until every adult in the country has been examined by a chest x-ray film will the first great stride have been made toward the eradication of a disease that kills more than 50,000 persons a year in the most productive period of life.

At the beginning of the organized national control movement, it was believed that the most effective means of discovering the exact nature of the tuberculosis problem in the United States was through surveys of industrial, occupational, and racial groups. It was soon discovered, however, that knowledge thus secured was at best spotty and was likely to be misleading when the whole population of the country was considered. It was therefore decided to delve into those reservoirs of human beings which are our great cities. Here, for active tuberculosis control, are all ages and races of men, all conditions of living, and a wide variety of maladies. Through a prompt discovery of the tuberculosis situation in the larger cities of our country, a reasonably exact knowledge of the extent of the problem could be realized, public action stimulated, and professional resources organized. City-wide surveys can be conducted with relative economy of money and effort. The concentration of personnel, machinery, and educational devices within densely populated communities provides, in certain respects, quicker and more reliable results than studies that are conducted in sparsely settled areas. The United States Public Health Service believes that there are four sound reasons for this concentration in cities.

First, the tuberculosis mortality and morbidity rates are highest in large cities. *Second*, no city has sufficient equipment to do the job in a short time, and, to control the disease effectively, it must be done in a short time. *Third*, surveys of large cities permit sound public health procedures, and significant foci of infection can, by this means, be removed from the population. *Finally*, programs of this type supplement health education technics in that they promote community organization to combat disease.

There are several important points that must be clarified concerning case-finding programs, not only in major cities, but also in smaller localities. The survey is always initiated on the local level. The Public Health Service participates only at the request of the city or county agency. One of the fundamental steps taken by the United States Public Health Service, prior to embarking upon a small-film survey, is that of securing approval of each local medical society. It follows that proper procedures for handling discovered cases must be presented to and approved by the medical group. Normally this is accomplished through a medical technical committee appointed for the survey by the local medical society. Of equal importance is the requirement that qualified personnel be provided for film interpretation and technical supervision of survey operations. Local specialists are designated by the

local medical society to be available for special consultations and assistance when needed.

As a result of small-film screening technics, great numbers of individuals with unusual shadows demonstrated on these films will come to the attention of radiologists. It is important to remember, however, that there is a degree of diagnostic inaccuracy inherent in any method of x-ray examination. This inaccuracy is independent of controllable factors such as mechanical technics and film-resolving powers. Small-film methods are basically for the purpose of screening; the final diagnosis and classification of lesions rest upon complete study and examination by standard methods. Expert film interpretation is therefore one of the crucial factors in a control program. Its lack can negate the benefits of efficient planning and the conduct of services, as well as hinder the execution of measures which must follow interpretation.

In the United States there are 92 cities with populations of over 100,000. In these 92 cities are more than 30,000,000 inhabitants of fifteen years of age or over. If we can x-ray this group in a short period of time, we will have examined 30.7 per cent of the population that must be covered, and have gone a long way toward the ultimate objective of x-raying each and every adult in the United States.

To augment existing case-finding activities in urban and rural areas, the proposed plan[2] for small-film screening of inhabitants of major cities calls for the utilization of from 12 to 24 x-ray microfilm units in any one city at a given time. Furthermore, the plan anticipates the screening of some 30,000,000 people in a reasonably short time, preferably within five years. Thus, it is obvious that a program of this type represents one of the outstanding opportunities in the field of public health. It provides large cities with the means to combat, control, and perhaps even eliminate for all practical purposes one of the scourges of mankind. Tuberculosis still ranks as number seven on the list of killers in this country. It ranks as number one in the cause of death in the age group fifteen to forty-four.

The case-finding program as envisioned for major cities calls for a small-film survey of one of the most important groups of citizens in this country. According to experience gained to date, at least 2 to 3 per cent of those x-rayed will require further and more refined roentgenologic study. The need for intensive and complete roentgen examination has become increasingly evident. What, then, is the major role of the roentgenologist in these large city programs? The answer is self-evident. As indicated previously, it is essential that persons trained in interpretation of chest films utilize their special skills and technics to identify lesions and to refer the cases in need of further study.

There are many important contributions that may be made by radiologists in these small-film mass screening programs. The x-ray supervision of many of the inactive cases discovered in surveys will fall to the roentgenologist. He will be called upon by many patients who, as a result of the survey, have been diagnosed as having pulmonary tuberculosis. It is well known, but not widely appreciated, that the medical practitioner in his daily work is one of the most important, if not the most important, of the forces for the control of tuberculosis. Although tuberculosis control is a social and an economic, as well as a medical problem, and although it calls for the best efforts of all those interested in human betterment, it is largely the medical profession that will complete the task of bringing the disease under real control. Progressive roentgenologists should consider themselves the guardians of the health of the communities they serve. They have the confidence not only of their patients, but of private general practitioners as well. Through their personal prestige in the community and through their organized societies, they can exert a powerful and effective

[2] Graphic illustrations were presented by the speaker to describe the plan in detail, with examples of its operation in selected cities.

influence in the nation's fight against tuberculosis. Only with the cooperation of the roentgenologist can the community achieve the good results which modern methods of tuberculosis control offer.

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DISCUSSION

L. R. Sante (St. Louis, Mo.): Dr. Hilbish's proposal for small-film survey of the inhabitants of large cities is indeed interesting. Since it has been shown that our progress in the control of tuberculosis for the past twenty years has been not so much from our methods of treatment but literally from early detection of the disease and isolation, it would certainly seem at first consideration that this is the method of accomplishing our ends, and indeed it may be so. We must, however, consider all aspects of such a program before it is blindly undertaken. It is true that diagnostic errors, even in the hands of some of the best men of the country, have been higher than would be expected, but there can be no doubt but what microfilm surveys have proved their worth and have come to stay.

Extension of such surveys to entire cities and even to all of the cities of a nation, however, is another thing. Take, for example, the city of Boston, with 500,000 inhabitants of survey age. Some 1,000,000 examinations were made last year throughout the entire nation; this would mean that one-half of the survey resources of the entire nation would have to be concentrated in a single city. In order to make a survey of the 92 large cities specified, containing 30,000,000 people, it would require thirty times the equipment and personnel now existent—quite an expansion of the U. S. Public Health Service. Since such surveys net about 1.5 per cent of positive cases, it would mean that about 7,500 cases would be detected in the 500,000 persons surveyed in Boston. These would be added to those already present and cared for. Now, I presume that conditions are not much different in Boston than in other similar large cities. In St. Louis our bed capacity for the care of tuberculous patients is perhaps 500 to 700 beds, with a substantial proportion of these not filled because of lack of personnel for their care.

It could be logically assumed, therefore, that from such a survey in Boston, there would be discovered a minimum of fifteen times as many tuberculous cases as they now have. How could such a number be properly cared for with present facilities? If you are not able to care for them properly and isolate them, what is the use of such a survey for their detection? Would it not be a better procedure first to acquire facilities for their adequate care? It would be a simple arithmetical problem to estimate the cost of buildings, furnishings, and other equipment and salaries for personnel to carry out such care. One can see that this would be a colossal undertaking. Likewise, having made such a survey, how long would it be of value as a representative picture? My answer would be, probably a maximum of three months. If such a survey had to be repeated every three months, then we can readily see that it would become one of the principal enterprises of the nation.

Still and all, it is a "noble experiment" and it is my opinion that such a representative survey should be made if for no other reason than to determine the feasibility of the undertaking.

SUMARIO

El Papel del Radiólogo en la Propuesta Toma de Radiografías Pequeñas de los Habitantes de Grandes Poblaciones

Con la elaboración de técnicas de placas pequeñas para radiografías, los radiólogos han tenido ocasión de descubrir sombras extrañas en un gran número de individuos, lo cual ha puesto de relieve la necesidad de realizar exámenes roentgenológicos más minuciosos y completos. Resulta, pues, indispensable que personas adiestradas en la interpretación de películas torácicas identifiquen dichas lesiones, utilizando para ello sus propias técnicas y destreza y seleccionando los casos que exigen estudio más detenido.

Indícase aquí que encuestas radiológicas verificadas en las 92 poblaciones de más de 100,000 habitantes en los E. U. A. ofrecerían un cuadro representativo de la situación actual con respecto a la tuberculosis y que las medidas antituberculosas basadas en los resultados obtenidos serían eficaces para reducir la incidencia de la enfermedad.

Some Radiologic Experiences with UNRRA in China[1]

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Winchester, Va.

THE HEALTH DIVISION of the United Nations Relief and Rehabilitation Program was organized to deal with anticipated epidemics, to provide sanitary engineers and public health officers for each province of occupied China, and to furnish a group of specialists in the various branches of medicine to act as instructors and advisors in the new medical centers. Physicians who joined the program were advised that adequate equipment had been purchased and would be available on their arrival in China, and each one was assured that a definite position or appointment awaited him. The actual conditions, therefore, so at variance with these assurances, led to a great deal of discontent and frustration among the medical personnel during the spring and summer of 1946. For some, this frustration continued throughout the year of service but most were able, by adapting incomplete supplies and equipment, to attain some success in their work.

The first incoming cargoes had been stored in warehouses without inventory, so tightly packed that even to sort and catalogue the goods on hand proved a tedious operation. Longshoremen's strikes, shortage of cargo boats, and difficulties in procurement all contributed to keep further supplies from arriving. Likewise a great uncertainty as to assignments had developed since the early plans were made in Chungking. Actual return to the occupied area revealed that formerly active hospital centers were unfit for operation, while other centers had been requisitioned by either the Chinese or the U. S. Army.

In radiology the situation was particularly bad. Few x-ray machines were in operation, and parts for existing equipment were not available. Electric power in most cities was limited, subject to great fluctuation in voltage and frequent interruptions in service, due mainly to worn-out generators and a universal lack of fuel. In some cities electricity was available for only one or two hours in the evening.

I had been scheduled to go to the Central Hospital at Nanking, which was to be the nucleus of the first of the five contemplated medical teaching centers. On my first trip there, in June 1946, the hospital was in process of moving to a new building. There was in use one pre-war Fisher x-ray unit for fluoroscopic work only. The tube had a poor focus; the fluoroscopic screen was indistinct and blurred, and in an unmounted frame, so that it had to be held by the examining physician while the tube was operated. Two hundred milligrams of radium had been received from UNRRA, but no clinical applicators were provided nor any storage receptacles! An adventurous surgeon had initiated the use of the radium by burying the needles in a sarcoma of the cheek, with no knowledge of the radiation desired or obtained. Some secondary infection had occurred and only slight tumor regression.

After I had cabled an urgent request that applicators be sent by air, and had arranged for the making of suitable lead storage receptacles for the radium, it was decided that I might best be employed in making various survey trips until more equipment was received at Nanking. Later I was also asked to give lectures at "refresher courses" in medicine in Anhwei province.

Survey trips were the panacea for controlling discontent among UNRRA workers. During the agonizing period while the urgently needed food shipments for the Honan famine area were delayed, survey teams were constantly dispatched there, the net result being a nutritional study on acute *vs.* chronic starvation, which was of

[1] Accepted for publication in January 1948.

little comfort either to the starving natives or the investigators.

In my visits to Peiping, Tientsin, Hangchow, and Wuhu I found everywhere the same lack of efficiently working equipment. In North China I saw two new Japanese installations but neither had a spare tube, nor could any be obtained if the need arose. Most of the installations were of German or American manufacture and had not been serviced during the eight years of war. Repairs to equipment had been so long neglected that one frequently saw units operated for fluoroscopy with no ammeter in the circuit. Static from installations in one hospital was so bad that the contact switch was closed through a double thickness of lead glove. Therapy units which had formerly been operated at 220 kv. were being used only for superficial therapy on the basis of apparent clinical effect, there being no ionization chambers available or even sphere-gap equipment for measuring voltage.

Films were almost non-existent; none had been received at that time from UNRRA. Later, when we tested incoming UNRRA film in Shanghai, we found that over three-fourths of the supply was so fogged by heat, from prolonged storage in India or the South Pacific, as to be worthless for roentgenography. A limited amount could be purchased from a Shanghai importer, but all film was subject to a luxury import tax which made the expense almost prohibitive for general use.

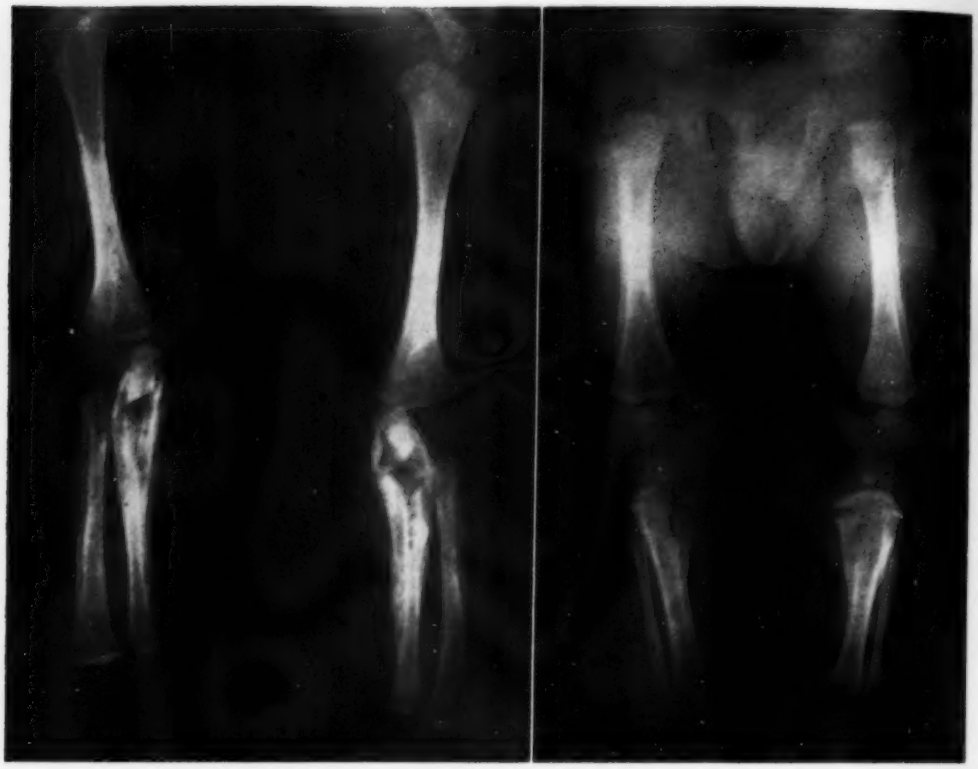
The buildings of the Peking Medical College were occupied by the American Armed Forces. The radium owned by that institution was still in the emanation plant, but permission to use or rehabilitate any of the equipment had not been obtained. The mercury from the radon pump had been removed by the Japanese. The radiologist and physicist, Drs. Hsih and Chu, of PUMC, were in charge of the department at Peita University and had maintained the most creditable radiological department seen in China, in spite of many difficulties. In Tientsin and Peiping, too, more active work was being done by the National Anti-Tuberculosis Society than elsewhere in China. Students were examined fluoroscopically at the first Public Health Clinic, and some industrial surveys, especially in the mining industries, had been started.

In Tientsin a community cancer hospital had been organized, but the complete lack of any radiotherapy facilities limited the work entirely to surgery.

In Shanghai radium was in use at the Belgium Radium Institute (privately owned) and also at the Chinese Red Cross Hospital No. 1. The Radium Institute owned two deep therapy units, which were repaired during 1946, but both operated below 200 kv. Except for this, no roentgen therapy was available in Shanghai.

On my return to Nanking, we were able to put the radium into use, finding methods of using radium alone in cases where roentgen therapy or a combination of roentgen and radium therapy were to be preferred. When an Army field x-ray unit was received, we made a series of skin tests and instituted x-ray treatment for skin diseases, such as ringworm, eczema, and neurodermatitis. The latter condition was unusually frequent, especially on the neck, in both men and women patients. Whether this is associated with the stiff, tight collar which is constantly worn is problematical. The number of cancer patients was impressive, but there had been an accumulation of such cases during the period when no radiotherapy was available, and patients also came from other cities for treatment.

In our roentgenologic work, I had anticipated seeing new disease entities. In this I was disappointed except for seeing disease developed to an extent seldom encountered in the United States, where medical care is more available. Tuberculosis was extremely frequent. Most of the pulmonary cases were diagnosed by fluoroscopy only. Films of bone lesions were made and offered a wealth of pathological data on tuberculosis, osteomyelitis, and above all of congenital syphilis. The latter condition was frequently demonstrable in



Figs. 1 and 2. Osseous lesions of congenital syphilis in Chinese infants.

infants and, whereas the films I had studied of American infants with positive serologic findings were usually difficult of interpretation and the findings ambiguous, I saw in Central Hospital the classical features of periosteal and bone changes in an unmistakable combination (Figs. 1 and 2). Evidently the lack of prenatal care for most mothers in China results in a more florid manifestation of the disease in the newborn child.

Evidence of rickets and scurvy and of other deficiency diseases were notably absent in the films seen at the Central Hospital. Physicians who made surveys of Nanking school children also reported that evidence of rickets and scurvy was very rare, and that dental caries was unusual except among the wealthier classes, by whom a taste for sweets had been acquired. A number of obstetrical patients were examined roentgenographically by the Snow Lewis method of pelvimetry. Disproportions were found in some instances, chiefly from outlet contractures, but none of the maternal pelves showed osteomalacic changes or evidence of preexisting rickets. I was told that osteomalacic changes are found in some areas of China—in and near Hong Kong, for example—but I had no opportunity to study any of these cases.

No patient with bound feet presented herself for x-ray study during the time I was in Nanking. Among older women the bound foot deformity is fairly common, especially in North China. The practice has been illegal since 1911, and the women are usually sensitive in regard to the deformity and loath to have it examined. One print of a roentgenogram of a bound foot was given me. I am told that this example is unusual in that the toes are not flexed under the foot (Fig. 3).

Fig. 3. Bound foot deformity in a Chinese woman. This case is considered unusual in that the toes are not flexed under the foot.

As in roentgenographic study everywhere, unusual syndromes were encountered, but they were the rare disease entities which might occur anywhere—such as the calcified craniopharyngioma associated with dwarfism, calcified cyst shadows of cysticercosis in a patient suffering from jacksonian attacks, and an extreme example of multiple chondromata.

Some service was given by the hospital to Chinese soldiers from the civil war front, for serious injuries. A Sweet localizer for determination of the position of foreign bodies in the orbit was one of the first complete x-ray accessories received. With wax models, we had developed a thorough training in the technic among interns, residents, and the staff of the radiological and ophthalmological departments before our three soldier patients were seen. In each instance, injury had occurred eight or ten days earlier; both eyes were blinded with multiple metallic fragments and there were dust particles in each eye. We doubted that the orbit was kept fixed in position for the two exposures because of the inability to focus one eye on a point. In spite of as careful localization as possible, the electromagnet available was unable to withdraw any fragments, due possibly, in part, to scar tissue formation before treatment was attempted.

There was usually no medical examination or attention given a Chinese soldier on induction or during his service except for spectacular injuries incurred in front-line fighting. Conscription consists of an unannounced round-up of all young men in a village on a certain day. The inductee with tuberculosis or other infectious disease enters barracks or camp life with others of the group and remains as long as he can march and perform other duties. If he drops out of line of march and is obviously too sick to continue, he may beg his way back to his home village.

Fig. 4. Localized gigantism or overgrowth of the second and third toes of the left foot in a Chinese soldier.

One exception to this general statement was a soldier showing a localized gigantism or overgrowth of the second and third toes of the left foot (Fig. 4) which had necessitated a homemade shoe twice the length of the right. This man had been referred for orthopedic advice, although his disability was unusual rather than an actual handicap.

The World Health Organization will continue some of the health projects of UNRRA, but with the continued civil war in China and the resultant economic distress in the country, little improvement in the general health picture can be expected.

Winchester Memorial Hospital
Winchester, Va.

SUMARIO

Problemas Radiológicos con la UNRRA en China

La A. relata algunas de sus observaciones mientras trabajaba en China con la División de Higiene de la Administración de Socorros y Rehabilitación de las Naciones Unidas. En todas partes las tareas del radiólogo eran obstaculizadas por la falta de instrumental eficiente y la escasez y excesivo costo de las películas.

En Nankin, donde la A. estaba, había radio y era empleado en casos en los que hubiera sido preferible habitualmente emplear rayos X o una combinación de roentgeno y curieterapia. Con el tiempo se adquirió un aparato portátil de rayos X de los del Ejército, y fué empleado en el tratamiento de afecciones cutáneas, tales como tiña, eczema y neurodermatitis. Observáronse, en gran numero, casos de cáncer, pero no nuevas entidades patológicas. Menciónase en particular la indudable existencia de las alteraciones óseas y periósticas de la sífilis congénita en lactantes y la falta de signos de raquitismo, escorbuto y otros enfermedades de deficiencia.

EDITORIAL

Photo by Trout-Ware

Dr. Edgar P. McNamee

President of the Radiological Society of North America

Leadership, knowledge of the problems confronting physicians in these times of social change, administrative experience, and a gift of friendship—these are the qualities that Dr. Edgar P. McNamee, who now assumes the presidency of the Radiological Society of North America, brings to that high office.

Dr. McNamee has been a practising radiologist in Cleveland since his return from service in the first World War. His training in the specialty began in the Army X-Ray School, Pittsburgh, Penna., in 1917 and continued at Cleveland City Hospital. He has been in charge of the Department of Roentgenology at St. Alexis Hospital since 1920 and from an early date has devoted part of his time to the private practice of roentgenology.

Dr. McNamee was born in Butler, Penna., in 1890 and, after receiving his early education there, went to the University of Pennsylvania, where he was awarded his M.D. degree in 1913. In the course of the first World War he saw service as a medical officer with the Third Division during engagements at Chateau Thierry, St. Mihiel, and in the Argonne.

The positions in which Dr. McNamee has served the medical profession are numerous. He was a Director of the Cleveland Academy of Medicine from 1938 to 1941 and a Councillor of the Ohio State Medical Association from 1938 to 1944, when he was elected President of that organization. Since 1944 he has been a member of the Board of Directors of the Radiological Society of North America, acting as its chairman in 1947. He has served as Secretary, Treasurer, and President of the Cleveland Radiological Society. The American Roentgen Ray Society elected him to membership in 1929; he is fellow of the American College of Radiology and also of the American College of Physicians, as well as a Diplomate of the American Board of Radiology. For two years, 1944 to 1946, Dr. McNamee served as vice-president of the American College of Radiology.

Dr. McNamee's interest in a well rounded life has never flagged through the years. His low handicap golf makes him a partner to be sought after; he keeps fit in the off-season by bowling and playing handball. With his charming wife, Ethel Petrie, he finds time to take vacation cruises to distant parts of the world.

In electing Dr. McNamee, the Society has an able executive and an experienced helmsman for piloting it through whatever storms, calms, or tides may be ahead during the coming year.

GEORGE L. SACKETT, M.D.

The Thirty-Fourth Annual Meeting

Piled on steep hills between the blue-green waters of the Pacific and the Bay, housed in white and cream, decorated with geraniums, palms, and eucalyptus, rises a great mound of hospitality known commonly as San Francisco. To the delight and edification of 1,150 members, their wives, and guests, the Radiological Society of North America elected to hold its Thirty-fourth Annual Meeting there, Dec. 5–10, 1948. In addition to a fine program of papers, refresher courses, and scientific exhibits, San Francisco offered generously a collection of extra-mural activities, such as views, stores, museums, Chinatown, and places of variety and interest that are unsurpassed by any city in the country. The numberless restaurants and bars provide unusual food and drink that make us wish that we, like the ruminants, were provided with two stomachs.

It is not possible to review nor even to mention all the outstanding papers that were presented. They will eventually appear in RADIOLOGY, where you will want to read some of them more than once. Monday morning's session was opened by a warm welcome from Dr. R. Stanley Kneeshaw, President-Elect of the California Medical Association. This was followed by the Presidential Address of Dr. L. Henry Garland, "Evaluation of Diagnostic Methods," a rewarding presentation, both from the standpoint of its constructive criticism and the usual skillful Garland presentation.

Monday afternoon, Dr. W. Edward Chamberlain exposed two more of his many

talents. He revealed himself as a producer of variety shows and a fine master of ceremonies, presiding over a two-hour vaudeville called, no doubt for scientific reasons, "A Wet Clinic on Radioactive Isotopes." The stars of the show, supplied apparently by Dr. Earl R. Miller's theatrical agency, were Drs. Chamberlain and Miller, Robert Newell, Edith Quimby, Richard Chamberlain (no relation to W. E. C.), George Henny, and a couple of Geiger counters that worked. It was a fine demonstration of the technic of handling radioactive isotopes, presented with liveliness and humor.

The Membership Dinner was delightful, and the business session following it a model of efficiently run parliamentary procedure. The business was disposed of with neatness and dispatch. This dinner was not nearly as well attended as it should have been. No doubt the temptations of Trader Vic's (not an ad) and other dispensers of gaiety were too great. Too bad! The business sessions of the Society are not as interesting as the amusements or the scientific sessions, but they are important.

Tuesday morning's joint session was exceptional. Three basic papers were read: "Hematological Effects of Ionizing Radiation," by Leon O. Jacobson, "Relationships Between Chemical and Biological Effects of Ionizing Radiation," by Raymond E. Zirkle, and "Studies of Apparent Submicroscopic Changes in Bone Matrix Associated with the Ionizing Radiations from Metabolized Radium," by Frank E. Hoecker and Paul G. Roofe. Without reflection upon the other two, special attention is called to Dr. Zirkle's paper because of its fundamental significance in the biology of radiation effects. The morning closed with a paper by Col. James P. Cooney on "A Proper Approach Toward Atomic Warfare." Considerable discussion followed. This controversial subject is at last receiving rational rather than an emotional approach.

A fine symposium on Peptic Ulcer was offered in the Diagnostic Section on Tuesday afternoon. The participants, Frederick E. Templeton, Milo T. Harris, Russell H. Morgan, Morris E. Dailey, Dwight L. Wilbur, Malcolm S. Watts, and Fred J. Hodges, presented many useful ideas. Assorted subjects connected with therapy and radiobiology were given in the Therapy Section. Dr. H. J. Muller presented his warning on the dangers of irradiation to posterity in a paper entitled "The Nature of Radiation Injury as Seen by the Geneticist." The threat as presented by Dr. Muller is more tangible and less menacing than is the newspaper reporting of his ideas.

The Carman Lecturer on Tuesday evening was Dr. Merrill C. Sosman, who spoke of "Xanthomatosis, a Metabolic Myth." Dr. Sosman's reputation is so well known to the Society that further painting of the lily is unnecessary. We are happy that we can honor Dr. Carman's memory with a speaker of such distinction.

A symposium on Pulmonary Disorders occupied the Diagnostic Section on Wednesday morning, including exceptional and interesting papers by Ross Golden and L. A. Rottenberg, Sabino di Rienzo, Laurence Robbins and R. C. Sniffin, Eugene Freedman and J. H. Billings, Charles E. Grayson and Helen Blumenfeld. Of striking interest and significance was Dr. di Rienzo's paper on "Radiological Aspects of Bronchial Dynamism." The Therapy Session offered five papers on various practical aspects of radiation therapy, given by Robert E. Fricke and J. T. McMillan, Milton J. Friedman and L. Lewis, William E. Howes, J. M. Read, and Juan A. del Regato.

On Wednesday afternoon, Morse J. Shapiro, Herbert Stauffer, Hugh M. Wilson Wendell G. Scott, Raúl A. Pereiras, M. S. Sussman, S. Dack, and D. H. Paly, and J. Frimann-Dahl presented to the Diagnostic Session what amounted to a symposium on the Diagnosis of Heart Disease. The Therapy Section, after two papers on recent data on the Betatron by Lauriston S. Taylor and Harold O. Wykoff and L. S. Skaggs, moved to the University of

Dr. Warren W. Furey, President-Elect, Dr. L. Henry Garland, retiring President, and Dr. Eugene P. Pendergrass at the Annual Meeting

California for a fascinating visit to the Cyclotrons.

A symposium on Intracranial Lesions was presented in the Diagnostic Section Thursday morning, with Barton R. Young, Philip J. Hodes, Eugene Pendergrass, John D. Camp, C. R. Perryman, J. W. Hope, John R. Hannan, Charles R. Hughes and Bert E. Mulvey contributing. The Therapy Section settled down after the trip to the Cyclotron Laboratory to more routine matters, with various papers on the daily problems of therapists.

Thursday afternoon the diagnosticians listened at the Fairmont to a symposium on Bone and Joint Disorders, with pelvimetry and high-voltage radiography thrown in. At the same time a symposium on Pediatric Problems, with roentgencinematography as an extra, was held at the Mark Hopkins. It took an agile diagnostician to get all he wanted that afternoon.

Thursday evening was the Annual Banquet—a delightful party, starting with anti-freeze dispensed by the Pacific Roentgen Society, continuing with a delicious banquet, fine music and dancing.

The Radiological Society of North America presented two Gold Medals this year, one to W. Edward Chamberlain and the other to Lowell S. Goin. No more gratifying choice could have been made. They deserve the honor not only for what they have done for the Society, but for what they have done and are doing for radiologists, and still more for what they are, good friends, held in high esteem for their warm personalities by all of us.

The Program Committee wisely had sessions only on Friday morning, presenting in the Diagnostic Section a medley of assorted subjects from Blastomycosis of the Lung to the Diagnosis of Disease of the Ileocecal Coil, and in the Therapy Section a symposium on Chemotherapy, Steroids, and Miscellaneous Topics.

Our thanks for this fine meeting are extended to the innumerable people who contributed to the many details; who put in countless hours when they would rather have been doing something else. They cannot all be named. Our appreciation goes first to those working behind the scenes. To those on stage, our thanks to the local Executive Committee, Bob Stone, Harold Hill, Ivan Miller, Arthur Williams, Earl Miller, Joseph Levitin, and Charles Capp. On behalf of the ladies, to Mrs. Robert Stone and Mrs. Bertram Low-Beer, co-chairmen of the Ladies Entertainment Committee, and to Mrs. Henry Garland, Mrs. Carl Bowen, Mrs. Tom Fullenlove, Mrs. Robert Newell, Mrs. Arthur Williams, Mrs. John Von Saltza, Mrs. Carl Benninghoven, Mrs. Ivan Miller, and Mrs. Charles Capp, our thanks for a very nice time. To Miss Dona Salsbury, Miss Bobbie Dudman, and Miss Jane Flower, our appreciation of their fortitude and patience in taking care of many details. And last, but far from least, special thanks to Don Childs, and his right hand and trouble shooter, Mrs. Paul Henry.

SYDNEY J. HAWLEY, M.D.

The Refresher Courses

The Refresher Courses at the 1948 meeting of the Radiological Society of North America again maintained their traditional popularity. As strenuous as our meetings have become, the chairman would not have blamed some of the old gray-haired students had they stayed in bed and missed these early morning lectures, but even with the gaiety of San Francisco, most of those registered appeared on time.

It has been suggested that, in order to relieve the overly full schedule of the annual meeting, which, as it is now, leaves everyone exhausted by its six days of activity, it might be advisable to drop the refresher courses from the schedule and pass this phase on to the American College of Radiology. The Committee invites the reaction of members of the Society to this proposal, though it believes that these courses serve a very useful purpose and should be continued in some manner.

It is interesting to note that 255 members, 111 guests, and 65 students from thirty-seven states, the District of Columbia, five provinces of Canada, Argentina, Belgium, Central America, Cuba, England, and Mexico registered for the courses.

The Committee wishes to thank the instructors; namely, Leo G. Rigler, Isadore Lampe, Merrill C. Sosman, John D. Camp, L. Henry Garland, A. O. Hampton, Fred J. Hodges, Marvin M. D. Williams, Justin J. Stein, John W. Budd, A. N. Arneson, Wendell G. Scott, Edith H. Quimby, Ray A. Carter, Frederic E. Templeton, Paul C. Hodges, H. M. Parker, Simeon T. Cantril, Ross Golden, William Harris, Edward B. D. Neuhauser, David G. Pugh, B. V. A. Low-Beer, Earl R. Miller, and J. A. del Regato, for their very excellent presentations.

The local committee, Charles Capp, L. C. Kinney, E. P. Halley, B. V. A. Low-Beer, G. King and H. Weyrauch, from the Pacific Roentgen Ray Society, co-operated in every way and could not have been more gracious hosts.

REFRESHER COURSE COMMITTEE
Paul C. Swenson, M.D.
Kenneth S. Davis, M.D.
C. Edgar Virden, M.D., Chairman

The Scientific Exhibits

The Thirty-fourth Annual Meeting of the Radiological Society of North America in San Francisco, from Dec. 5 to 10, 1948, attracted 42 scientific exhibitors. This was an outstanding number, and the exhibits were of an especially high quality.

Nine special awards were made. Dr. Sabino di Rienzo of Cordoba, Argentina, received first award for his exhibit on "The Radiological Aspect of Bronchial Dynamism." The second award was made to Anna Goldfeder, Sc.D., New York City, for her exhibit on "Effects of Radiation on Normal and Malignant Tissue Cells." Dr. Laurence Robbins and Dr. Ronald C. Sniffen, Massachusetts General Hospital, received third award for their work on "Cholesterol Pneumonitis: A Correlation of the Roentgenologic and Pathologic Findings." Honorable mention was given to six exhibitors, as follows:

1. The Army Institute of Pathology for their exhibit, "Giant-Cell Tumors—Meningiomas—Educational Materials." This exhibit was under the direction of Dr. Howard B. Latourette, Dr. John Hope, and Col. J. E. Ash.

2. "Pneumarthrography of the Knee," by Maurice Sachs, M.D., W. H. McGaw, M.D., H. E. Snedden, M.D., and J. M. Muckley, M.D., Cleveland, Ohio.

3. "Handling and Measuring Radioisotopes," by W. E. Chamberlain, M.D. Richard H. Chamberlain, M.D., George Henny, M.S., Earl Miller, M.D., Robert Newell, M.D., and Edith Quimby, Sc.D.

4. "Isotopes and Radiology," by Dr. Paul C. Aebersold and Dr. Nathan H. Woodruff of the Atomic Energy Commission.

5. "Diagnosis of Congenital Heart Disease by Angiography and Aortography," by Wendell G. Scott, M.D., Merl J. Carson, M.D., Thomas H. Burford, M.D., and Sherwood Moore, M.D., St. Louis.

6. "Clinical Applications of Cineradiography," by G. H. Ramsey, M.D., J. S. Watson, M.D., S. A. Weinberg, M.D., F. W. Dreisinger, M.D., and J. J. Thompson, M.D., Rochester, N. Y.

EXHIBITS PERTAINING TO THE SKELETAL SYSTEM

FRANK E. HOECKER, PH.D., AND PAUL G. ROOFE, PH.D. (*Lawrence, Kansas*): Autoradiographic Studies of the Distribution of Metabolized Radium in Relation to Bone Structure. This exhibit consisted of a number of photomicrographs of bone sections prepared by means of a new technic, photomicrographs of nuclear-track-plate autoradiograms of these sections prepared by a method which correlates the alpha-particle tracks with the bone cells in which they originate.

A. J. WILLIAMS, M.D. (*San Francisco*): The Costal Joints in Rheumatoid (Marie-Strümpell) Arthritis. This exhibit showed the technical procedure necessary for the demonstration of the costovertebral and transverse joints.

HOWARD B. LATOURETTE, M.D., JOHN W. HOPE, M.D., AND J. E. ASH, COL., U.S.A., RET. (*Army Institute of Pathology, Washington, D. C.*): Giant Cell Tumors of bone—Meningiomas—Educational Materials. Two of the three parts of this exhibit were devoted to giant-cell tumors of bone and meningiomas, including pertinent roentgenograms and photomicrographs of histopathologic material. The third part consisted of educational materials for examination.

LEWIS E. ETTER, M.D. (*Pittsburgh, Penna.*): New Method for Roentgen Anatomical Study of the Skull. The method of study of the skull set forth by Dr. Etter consists in disarticulating the various component bones and making roentgenograms of them separately in various standard projections, and then of the whole dried skull, with and without the bone in question. In this way the exact features contributed by an individual bone to the outlines of the living roentgenogram can, by comparison, be clearly delineated. The development of visual-aid methods was also well demonstrated.

GEORGE S. SHARP, M.D. (*Pasadena, Calif.*): Oral Cancer and Tumors of the Jaws. Kodachrome transparencies illustrated early oral cancer on all mucosal surfaces. They were accompanied by brief descriptions of the radiation treatment. Cysts (odontogenic and non-odontogenic) and tumors (benign and malignant) of the jaws were illustrated, and pertinent points on therapy were brought out.

M. D. SACHS, M.D., W. H. MCGAW, M.D., H. E. SNEDDEN, M.D., AND J. M. MUCKLEY, M.D. (*Cleveland, Ohio*): Pneumarthrography of the Knee. This exhibit consisted of roentgenograms of the normal knee joint in varying degrees of rotation, different types of medial and lateral meniscus tears, cysts, tumors, osteochondritis dissecans, traumatic and Charcot joints. Each roentgenogram was accompanied by diagrammatic anatomic sketches and a brief summary of clinical, surgical, and pathological observations and end-results.

M. S. ABEL, M.D., AND IRVING I. LOMHOFF, M.D. (*Oakland, Calif.*): Sacroiliac Changes in Traumatic Paraplegics. This exhibit showed reductions of spinal, pelvic, and sacroiliac films for eight patients, with brief case summaries for each. One hundred traumatic paraplegics were thus studied. All had vertebral fracture-dislocations and 59 showed sacroiliac changes. These changes varied from minimal narrowing of the joints to complete bony ankylosis.

JOHN F. HOLT, M.D., AND WILLIAM I. OWENS, M.D. (*Ann Arbor, Mich.*): Sarcoidosis of Bone. Roentgenograms, photographs, and photomicrographs of patients with osseous manifestations of Boeck's sarcoid observed at the University of Michigan Hospital during the past five years were exhibited. Particular emphasis was placed upon the true incidence of bone lesions in this disease, their typical roentgen appearance, which frequently has been misrepresented, their relation to other sarcoid lesions, and their ultimate fate in the course of the disease.

EXHIBITS PERTAINING TO THE CARDIOVASCULAR SYSTEM

H. P. BREAN, M.D. (*Palo Alto, Calif.*), J. H. MARKS, M.D., M. C. SOSMAN, M.D., AND M. J. SCHLESINGER M.D. (*Boston*): Calcification in Myocardial Infarcts. Selected material from a study of a dozen cases of massive calcifications in old myocardial infarcts was presented.

WENDELL G. SCOTT, M.D., MERL J. CARSON, M.D., THOMAS H. BURFORD, M.D., SHERWOOD MOORE M.D. (*St. Louis*): Diagnosis of Congenital Heart Disease by Angiography and Aortography. A series of diagrams and photographs of the "Tautograph," demonstrated a new mechanism for complete automatization of the roentgenographic technic for angiography. Angiograms demonstrating typical cardiovascular defects were included, together with diagrams illustrating the abnormal circulation in each. Indications and contraindications for beneficial or corrective cardiac surgery were described. A demonstration of a new method for "retrograde arterial angiography" for the diagnosis of coarctation and persistent patency of the ductus arteriosus was also included.

H. M. STAUFFER, M.D., M. J. SHAPIRO, M.D., AND LEO G. RIGLER, M.D. (*Minneapolis*): Diagnosis of Operable Congenital Heart Lesions by Conventional Methods. The classic roentgenologic features of patent ductus arteriosus, tetralogy of Fallot, and coarctation of the aorta were contrasted with the more common variants and those lesions which must be differentiated. The practical possibilities of selecting cases for operation on the basis of the ordinary clinical and roentgenologic examinations were stressed.

JUAN M. VIAMONTE, M.D., R. HERNÁNDEZ BEGUERIE, M.D., AND J. J. CENTURION, M.D. (*Habana, Cuba*): Preliminary Report on Angiocardiographic Studies in Adults. In this exhibit radiographs demonstrating angiocardiography, using levograms and dextrograms, were shown. The application of this method in differential diagnosis of mediastinal diseases was brought out.

RAÚL PEREIRAS, M.D., AND AGUSTÍN CASTELLANOS, M.D. (*Habana, Cuba*): Superior Retrograde Aortography. A series of x-ray reproductions illustrated an indirect radiological sign permitting the diagnosis of aortic coarctation. Normal and pathological cases were shown.

EXHIBITS PERTAINING TO THE CENTRAL NERVOUS SYSTEM

R. J. HEALY, Lt. Col., M.C. (*San Francisco*): Benign Neurogenic Neoplasms. This exhibit demonstrated the positive findings in cases of certain benign neurogenic neoplasms, including ganglioneuroma, neurofibroma, neurolemmoma, neuroma, and meningiomas.

C. R. HUGHES, M.D., J. R. HANNAN, M.D., AND B. E. MULVEY, M.D. (*Cleveland, Ohio*): Spinal Cord Tumors. Selected material from a group of 65 proved spinal cord tumors served to emphasize the roentgen criteria as demonstrated on plain films and myelograms. Clinical information and histopathological features were correlated with the x-ray findings.

EXHIBITS PERTAINING TO THE CHEST

FRANK ISAAC, M.D., RICHARD OTTOMAN, M.D., AND EDWIN P. BUGBEE, M.D. (*Van Nuys, Calif.*): Bronchial Obstruction in Pulmonary Neoplasm. Several cases of proved bronchiogenic carcinoma were presented. Bronchial obstruction was shown by planigrams at the appropriate levels. Examples of both complete and partial obstruction (stenosis) of the main as well as secondary bronchi were shown.

LAURENCE L. ROBBINS, M.D., AND RONALD C. SNIFFEN, M.D. (*Boston*): Cholesterol Pneumonitis: A Correlation of the Roentgenologic and Pathologic Findings. This exhibit consisted of illustrative cases of cholesterol pneumonitis with demonstration of roentgen findings, the gross appearance of the lung and photomicrographs of surgical specimens.

F. J. WEBER, M.D., AND H. F. A. LONG (*Washington, D. C.*), C. C. BIRKELO, M.D., AND W. L. BROSIUS, M.D. (*Detroit*): Correlation of Roentgenological and Pathological Findings in Pulmonary Diseases. Reproductions of antemortem and postmortem roentgenograms illustrated the changes in pulmonary disease, including changes in the arterial system. Sectioned gross specimen photographs of each case were shown.

CHARLES E. GRAYSON, M.D. (*Sacramento, Calif.*): Egg-Shell Calcifications in Silicosis. The peculiar annular calcifications in the hilar and mediastinal lymph nodes of patients having silicosis of many years duration were demonstrated by an interesting collection of films. The cases were not "proved" histologically.

CARROLL C. DUNDON, M.D. (*Cleveland, Ohio*): Periostitis Associated with Carcinoma of the Bronchus. Illustrative chest films from six cases of carcinoma of the bronchus were shown, together with roentgenograms of long bones and joints revealing an unexpected periostitis. Some of the patients were treated by pneumonectomy, and serial roentgenograms of the extremities showing decrease or disappearance of the periostitis following surgery were included.

H. C. HARRELL, Lt. Col., M.C., L. H. EDDLEBLUTE, Capt., M.C., AND D. E. BIBBY, Capt., M.C. (*Hot Springs, Ark.*): Pulmonic Manifestations of Acute and Chronic Tularemia. This exhibit consisted of transparencies of nine cases of proved pulmonic tularemia.

SABINO DI RIENZO, M.D. (*Cordoba, Argentina*): Radiological Aspect of Bronchial Dynamism. This exhibit contained numerous original spot bronchograms, normal and pathologic, illustrative of "dynamism" in asthma, emphysema, carcinoma, and in hydatid cysts. The physiology and physiopathology of cough were bronchographically recorded in its preparatory and expulsive phases, proving the existence of a peristaltic wave and showing the similarity of the acts of coughing and vomiting. The exhibit pointed out the radicular spasm, transitory and permanent, as well as the possibility of the act of coughing taking place in a single lung or even in a single lobe.

EVERETT L. PIRKEY, M.D., S. M. ROBERTS, M.D., EDSEL REED, M.D., AND WILLIAM H. SMITH, M.D. (*Louisville, Ky.*): Roentgen Diagnosis of Carcinoma of the Lung. About fifteen cases of carcinoma of the lung, proved by biopsy, operation, or autopsy in the past year, were presented.

No two of these cases had the same x-ray appearance. They simulated almost every type of disease from pulmonary tuberculosis to pericardial effusion. Several of the cases were followed by films a year or more before the present condition developed.

EXHIBITS PERTAINING TO THE GASTRO-INTESTINAL TRACT

P. E. RUSSO, M.D., H. C. SEBESTED, M.D., AND J. R. DANSTROM, M.D. (*Oklahoma City*): Abdominal Calcifications. This exhibit consisted of a presentation of cases with abdominal calcifications (exclusive of gallstones and renal stones): calcifications of abdominal vessels and abdominal organs, such as the gallbladder and pancreas, pancreatic cysts, uterine fibroids, pelvic teratoma, coproliths, seminal vesicles, and vas deferens. Most of the cases were proved by either surgery or autopsy.

ROBERT K. ARBUCKLE, M.D., C. J. ATTWOOD, M.D., AND WM. H. SARGENT, M.D. (*Oakland, Calif.*): Cystic Fibrosis of the Pancreas. Chest roentgenograms of six cases of cystic fibrosis of the pancreas showed what were considered to be characteristic pulmonary pathologic changes. For each of the cases photomicrograph transparencies of the histologic changes found at autopsy, both in the pancreas and in the lung, were included. The familial occurrence of the disease was demonstrated by chest films of siblings. The diagnosis in these two cases was established by duodenal assay.

H. M. WEBER, M.D., AND J. R. HODGSON, M.D. (*Rochester, Minn.*): Lesions of the Ileocecal Region. Films of the ileocecal region were shown, with special emphasis on the diagnostic aspects of regional enteritis. Normal variations and other inflammatory diseases of the intestine and neoplasms which must be differentiated from regional enteritis were illustrated.

SAMUEL RICHMAN, M.D. (*Richmond, Va.*): Roentgen Manifestation of Extrinsic Pressure on Stomach and Duodenum. This exhibit consisted of roentgenograms demonstrating the appearance of encroachment upon and displacement of the stomach and/or duodenum by pathological changes in structures closely associated with these parts. Cases were shown illustrating the possibility of a correct anatomical diagnosis based upon these criteria.

EXHIBITS PERTAINING TO THE GENITO-URINARY TRACT

THOMAS M. FULLENLOVE, M.D. (*San Francisco*): Uterosalpingography. This was an exhibit demonstrating cases which showed minor pathological changes and anomalies discovered in the course of sterility studies.

EXHIBITS PERTAINING TO RADIOACTIVE ISOTOPES

W. EDWARD CHAMBERLAIN, M.D., RICHARD H. CHAMBERLAIN, M.D., AND GEORGE C. HENNY, M.S. (*Philadelphia*), EARL MILLER, M.D., AND ROBERT R. NEWELL, M.D. (*San Francisco*), AND EDITH H. QUIMBY, Sc.D. (*New York*): Handling and Measuring Radioisotopes. The procurement, transportation, reception, handling, measurement, and disposal of radioactive isotopes were demonstrated. Small quantities of I^{131} and P^{32} were used for the demonstration.

PAUL C. AEBERSOLD, Ph.D., AND NATHAN H. WOODRUFF (*Oak Ridge, Tenn.*): Isotopes and Radiology. The uses of radioisotopes for diagnosis, therapy, and tracer work were demonstrated by charts and photographs. Photographs and charts were also shown demonstrating the health physics aspects and associated problems and technic for safe handling of radioisotopes.

HOWARD A. CARTER AND FREDERIC T. JUNG (*Chicago*): Physics of the Geiger-Müller Counter. The physics of the Geiger-Müller counter were demonstrated in this exhibit by the use of charts and diagrams and the component parts used in the assembling of this instrument.

EXHIBITS PERTAINING TO THERAPY

ANNA GOLDFEDER, Sc.D. (*New York*): Effects of Radiation on Normal and

Malignant Mammalian Tissue Cells. This exhibit consisted of photomicrographs and charts illustrating the direct and indirect action of radiation on cellular components of normal and malignant mammalian tissues, with a discussion on the physics of radiation.

EDWIN C. ERNST, M.D. (*St. Louis*): Cancer of the Cervix—Radium Therapy. Newer methods of applying radium in carcinoma of the cervix were demonstrated and illustrations of the microscopic and macroscopic pathology before and after radium therapy were included.

HOWARD B. HUNT, M.D., RALPH C. MOORE, M.D., AND ROBERT M. COLEMAN, M.D. (*Omaha, Neb.*): Carcinoma of the Cervix. An analysis was presented of the efficacy of treatment by radium alone (22 per cent 5-year survival) and by radium plus deep x-ray therapy (42 per cent), in the State University Hospital, and with individualized management of earlier cases seen in private practice (66 per cent 5-year survivals). Technical details of treatment were demonstrated.

EGON LORENZ AND T. B. DUNN (*Bethesda, Md.*): Eye Lesions Produced in Mice by Roentgen-Ray Exposure at Birth. A group of photomicrographs illustrated injury to structures of the eye found in year-old strain-A mice exposed to 400 r whole body x-irradiation within twelve hours of birth. Photomicrographs of structures of normal mice were used for comparison.

BERNARD ROSWIT, M.D. (*New York*): The Role of Nitrogen Mustard as an Adjunct to Radiation Therapy in Malignant Diseases. By means of charts and photographs the exhibitor demonstrated the use of nitrogen mustard as an adjunct to radiation therapy for the management and treatment of malignant lymphomas and leukemias.

EXHIBITS ON MISCELLANEOUS SUBJECTS

J. S. WATSON, M.D., S. A. WEINBERG, M.D., F. W. DREISINGER, R.T., J. J. THOMPSON, M.D., AND G. H. RAMSEY, M.D. (*Rochester, N. Y.*): Clinical Application of Cineradiography. This was an exhibit consisting of a 15-mm. film projector together with charts, photographs, and printed descriptions of equipment showing some of the clinical applications of cineradiography.

WILLIAM STRONACH (*Chicago*): Display Showing Program and Functions of the American College of Radiology. The various functions and the program of the American College of Radiology were demonstrated by means of wall charts and publications.

JOHN F. ROACH, M.D. (*Baltimore, Md.*): Mass Photofluorography. This exhibit illustrated the experimental findings of a study now in progress to explore the applicability of the Schmidt camera in mass photofluorography, with particular reference to the early diagnosis of gastric cancer.

RAYMOND A. DILLON, M.D., AND WILLIAM P. MURPHY, M.D. (*Boston*): Portable X-Ray Film Projector. This exhibit demonstrated in actual application the use of an optical apparatus designed and constructed for the projection of original x-ray films on a large screen before large or small audiences. Wall charts were used to show the theory of operation and construction detail.

CHARLES E. DUISENBERG, M.D., SYDNEY F. THOMAS, M.D., AND WILLIAM PICARD, M.D. (*San Francisco*): Semi-Automatic Rapid Film Changer. The exhibitors demonstrated the use of a rapid film changing machine, using 11 × 14″ films with exposures of fractions of a second for angiography and for various rapid physiological processes.

WALTER L. STILSON, M.D., AND JAMES R. MCNAUGHTON, M.D. (*Los Angeles*): The Use of an Abridged Standard Nomenclature in Indexing Radiological Lesions. Placards were used explaining the standard nomenclature and its use in the Department of Radiology at the White Memorial Hospital. Examples of pathological entities were followed from the film through the system to the lesion file.

Commercial Exhibits

ANSCO CORPORATION (*Binghamton, N. Y.*) featured x-ray films, chemicals, and colored prints, the last obtained from the local dealer because of breakage of the original exhibit during transit. A service of the Ansco Corporation is the printing of two booklets, one entitled "Dosage Calculations in Radium Therapy," by Dr. Edith H. Quimby, and a second entitled "Methods of Computing and Charting Tumor Dosage in X-ray Therapy," by William E. Howes, M.D.

GEORGE W. BORG CORPORATION, GIBBS DIVISION (*Delavan, Wis.*) exhibited a floor-to-ceiling tube stand, with electric locks. The x-ray table itself contained a Scholz Four-in-One spot device. In addition to the usual apparatus on the table was a scale contained on a tube support, for changing the kilovoltage, as gauged by the centimeter thickness method, in order to expedite taking films in different positions. The control stand of the Quadromatic unit contained separate kilovoltage controls for fluoroscopy and spot radiography. There was also a tube overload safety control on the timer, which functioned by changing the position of automatic setting stops when different milliamperages were used. The Quadromatic was rated at 250 ma. at 99 kv. The transformer featured a valve current control, available on the outside.

BUCK X-OGRAPH COMPANY (*St. Louis, Mo.*): The Buck X-Ograph exhibit consisted of an x-ray film illuminator bank, with space for eight 14 × 17″ films. The unit had a handy shelf and storage space below. Literature was available on Buck x-ray films, chemicals, developing tanks, drying and wet film transfer cabinets, and sundries.

CANADIAN RADIUM & URANIUM CORPORATION (*New York*) showed a complete line of radium applicators, featuring particularly the new ophthalmic applicator utilizing radium D.

E. I. DU PONT DE NEMOURS (*Wilmington, Del.*) had a display featuring x-ray films, intensifying screens, developers, and general photographic sundries.

EASTMAN KODAK CO. (*Rochester, N. Y.*) featured the new method of hermetically sealing x-ray films, using lead foil as a wrapper. There was also a large display of x-ray and other films, developing solutions, film cutters, a new Kodachrome projector, and cameras.

ELDORADO MINING & REFINING CO., LTD. (*Ottawa, Ontario*) showed a large line of radium applicators. A new item was the carrying case, with the handle so arranged as to prevent accidental opening of the container. Their monel-faced radium plaques featured a new method of soldering the facing to prevent leaks.

EUREKA X-RAY TUBE CORPORATION (*Chicago*) displayed a variety of x-ray tubes for dental, mobile, and stationary x-ray machines. Their new rotating target tube was shown in a glass casing.

GENERAL ELECTRIC X-RAY CORPORATION (*Milwaukee, Wis.*): The feature of the General Electric Exhibit was the new Maxiscope 500. The table was hydraulically driven and contained a novel screen support and a new spot-filming device. The Bucky was of the reciprocating type, with a removable grid, to enable replacement by a higher ratio grid, for high-voltage radiography. The tube stand was of new design, as was the tube support, with motion being controlled from the operator's side. The tube rail telescoped. The control stand contained phototiming devices for spot-film, Bucky, extremity, and chest work. There were also a heat-storage indicator and an automatic cut-off, if the controls were set for values beyond the tube rating.

KELLEY-KOETT MANUFACTURING CO. (*Covington, Ky.*) featured their new C-Supertilt table, which is constructed to give 45 degrees Trendelenburg tilting.

The screen support and spot-film device also have been revised. The 300-ma. generator was rated at 120 kv.p. Also shown was the new line of Kelley-Koett instruments for protection from radiation.

LIEBEL-FLARSHEIM CO. (*Cincinnati, Ohio*) showed their reciprocating Bucky, a motor-driven x-ray timer, a hand timer, and their bantam Bucky. Literature was available on their other products, including stationary filter grids, the Hugh H. Young urological x-ray table, serialographic tunnel, and the kymograph.

MACHLETT LABORATORIES (*Springdale, Conn.*): A large assortment of x-ray tubes was shown by Machlett Laboratories, but the chief features of their exhibit were the Dynamax 26, a rotating anode tube for under the table, and the new Superdynamax rotating anode tube for high-voltage radiography, up to 120 kv.p.

F. MATTERN MANUFACTURING CO. (*Chicago*) showed a diagnostic unit, featuring phototiming for Bucky, spot-film, chest, and extremity work. A novel device of the phototimer was the selection of a high, medium, or low density exposure, at any of the standard part settings. The x-ray table had a Scholz Four-in-One spot device and featured a motor drive on both sides. A photofluorographic unit was also displayed.

WM. MEYER CO. (*Chicago*) exhibited the Meyer Head Radiographic Specialty Unit, rated at 40 ma. at 90 kv.p. It is pedestal-mounted, and all the units rotate in a vertical plane on a large arm. Also shown was a portable x-ray unit with a tripod stand.

PAKO CORPORATION (*Minneapolis, Minn.*) showed a small, semiautomatic processing unit and photographs of the Model 30 x-ray film processing machine, and of the proposed "Pakotanx."

PICKER X-RAY CORPORATION (*New York*) displayed their new Craniograph, with tube and Bucky on a single arm, which rotates 360 degrees around a horizontal axis, and 55 degrees around a horizontal axis at right angles to the first motion. The Bucky can be angulated independently and is removable. All of the locks are of the friction type. The cassette holder contained a Serialographic feature. The Series 200 table was shown, with a new motor-driven spot-film device. The Pictronic 200 control stand featured electronic timing and electronic stabilizer, and an electronic starter for tube rotation.

POOLE & PARKER, INC. (*Tulsa, Okla.*): A resonant transformer was shown, containing an end ground tube and featuring operation at a continuous stepless range of 35,000 to 285,000 volts. The operating unit was 14 inches in diameter and 38 inches long, and weighed 108 lb. A focal skin distance of 3.2 cm. can be obtained.

RADIOLOGY (*Detroit, Mich*): A large blow-up of the cover of RADIOLOGY for October 1948 called attention to the fact that the Society's official publication has passed its twenty-fifth birthday. Complimentary copies of the Silver Anniversary number were available. The new Cumulative Index (1943–1947) was also shown.

RADIUM CHEMICAL CO., INC. (*New York*) displayed radium containers and accessories for the treatment of cancer and allied diseases. The featured item was the Ernst cervical applicator.

SCHERING CORPORATION (*Bloomfield, N. J.*) had a display featuring Priodax, Neo-iopax, Oreton, and Cortate.

FRANK SCHOLZ X-RAY CORPORATION (*Boston, Mass.*): The new Six-in-One spot-filming device of the Scholz Corporation had as a feature a time-selector switch mounted on the fluoroscopic screen, giving a choice of five different times. It can be used with any electronic timer, either of the Morgan type or one mounted in the control stand.

STANDARD X-RAY CO. (*Chicago*) showed a double-column tube stand, for therapy, at 220 kv. The control desk was of the console type. They displayed, also, a diagnostic control stand for a 200-ma. generator, and the Imagraph, a photofluorographic unit.

STANFORD X-RAY STEREOSCOPE CO. (*San Jose, Calif.*) introduced its new aluminized front-surface, quartz-coated mir-

rors, which are now standard equipment in the improved table and pedestal model stereoscopes.

VICTOREEN INSTRUMENT CO. (*Cleveland, Ohio*) showed a large assortment of radiation meters, among them the condenser meter (Glasser-Seitz type), the Minometer, a portable survey meter, the new Proteximeter, the 263 portable beta and gamma Geiger-Müller counter, and the Integron IV.

WESTINGHOUSE ELECTRIC CORPORATION (*Pittsburgh, Penna.*) showed its Duoflex table, with a new Four-on-One spot-film device and a new screen support. The Autoflex control, rated at 200 ma. at 125 kv., featured a swinging front panel, for easier servicing. It contained an electronic timer, with tube safety devices. The Theraflex wall mount arm, for 150 kv. therapy, was also shown. It contained a del Regato visual field localizer, or could be adapted to cones. There were photographs of other items of equipment, including the Chamberlain Multiplane Fluoroscope. The exhibit also included the Sanchez-Perez Multimatic Seriograph.

WINTHROP-STEARNS, INC. (*New York*) advertised Diodrast, the 35 per cent for intravenous pyelography, and the 70 per cent for angiography. Skiodan, for retrograde pyelography, and Skiodan Acacia, for uterosalpingography, were also illustrated.

ANNOUNCEMENTS AND BOOK REVIEWS

AMERICAN BOARD OF RADIOLOGY CERTIFICATION OF RADIATION PHYSICISTS

Beginning Jan. 1, 1949, The American Board of Radiology will examine and certify physicists as radiation physicists. Three types of certificates will be granted: (1) Radiological Physics; (2) X-ray and Radium Physics; and (3) Medical Nuclear Physics. Both (2) and (3) are included in (1).

Each applicant for any one of the certificates in radiation physics will be required to meet the following standards:

(*a*) Satisfactory moral and ethical standing.

(*b*) That he holds himself to be a specialist in the category of physics designated in his application.

(*c*) That he be a citizen of the United States or Canada. Candidates from any other country must be permanent residents of that country and native citizens thereof.

(*d*) That he holds a degree of Bachelor of Arts or its equivalent and has majored in physical science or engineering.

(*e*) That he be a member of the American Physical Society or similar organization.

(*f*) That after graduation from college he has had at least one year postgraduate experience in radiation physics or in a radiation physics laboratory.

(*g*) Candidates for examination in Radiological Physics, in addition to requirements specified in paragraphs (*a*), (*b*), (*c*), (*d*), (*e*), and (*f*), must have had at least one year of experience in association with a Department of Radiology approved by the Board and throughout one of the two years specified must have had experience in medical application of artificial radioactive materials.

Each candidate shall submit with his application personal records of calibrations of one low-voltage and one high-voltage x-ray apparatus, personal records of one x-ray protection survey and one protection survey for radioactive materials.

(*h*) Candidates for examination in X-ray and Radium Physics, in addition to requirements specified in paragraphs (*a*), (*b*), (*c*), (*d*), (*e*), and (*f*), must have had at least one year of experience in association with a Department of Radiology approved by the Board. With the application they must submit records of personal calibration of one low-voltage and one high-voltage x-ray apparatus and personal records of one x-ray protection survey and one personal protection survey for radium.

(*i*) Candidates for examination in Medical Nuclear Physics, in addition to requirements specified in paragraphs (*a*), (*b*), (*c*), (*d*), (*e*), and (*f*), must have had one year of experience in physical procedures relative to medical application of radioactive materials.

(*j*) Applications shall be endorsed by a Diplomate of the American Board of Radiology and a Diplomate in Radiological Physics who have personal knowledge of the experience, training, moral and ethical standing of the applicant and that he is qualified to take an examination.

(*k*) A fee of $25.00 shall accompany the application, which will be refunded if the application for examination is not accepted.

(*l*) Applications shall be submitted to the Secretary of The American Board of Radiology. He shall forward them to the Credentials Committee on Radiological Physics to be appointed by the Board, who shall decide about the candidate's fitness to be examined. Those approved for examination shall be informed by the Secretary of the Board when and where to appear.

Examinations will usually be conducted at the time and place of the regular or special meetings of the American Board of Radiology.

Examinations in radiation physics shall be oral, though practical or written examinations may be required. Examinations will be designed to test the candidate's knowledge and his fitness to practise physics in the category for which he applies. Accordingly, the examination may include questions regarding the structure of matter, construction and operation of x-ray apparatus, the use of radiation measuring instruments, determination of radiation quantity and quality, protection from x-rays, radium and artificial radioactive substances, preparation of radioactive applicators, determination of dosages of x-rays, radium and radioactive substances, and other matters relative to the category in which the candidate applies.

Candidates who fail an examination shall not be admitted to another examination until one year has elapsed. They must request re-examination at least sixty days prior to the next meeting of the Board and pay an additional fee of $10.00.

A diploma may be revoked if in the opinion of the Board a misstatement of fact has been made in the application or any other communication to the Board or its representatives, or for expulsion from a scientific society for misconduct. Under such circumstances the diplomas must be returned to the Board and the name of the individual shall be omitted from the Registry of Diplomates.

Address all communications to the Secretary of the American Board of Radiology.

B. R. KIRKLIN, M.D., *Sec'y,*
Mayo Clinic
Rochester, Minn.

THIRD INTER-AMERICAN CONGRESS OF RADIOLOGY

The Third Inter-American Congress of Radiology will be held in Santiago, Chile, from Nov. 11 to 17, 1949. Prior announcements of the meeting have elicited many inquiries regarding transportation.

The radiologist who has ample time and would enjoy an ocean voyage can sail from New York or New Orleans and twelve days later arrive in Rio de Janeiro, where a program of visits to medical institutions and scenic high spots can be arranged. Thence he may continue to São Paulo, *via* Pan American World Airways, visiting Montevideo, Buenos Aires, the Chilean lakes, and Santiago.

After the Congress has ended, a northern flight can be arranged with stops at Arequipa, the Incaland country, Lima, Quito, Cali, Bogotá, Medellín, Balboa, C. Z., Guatemala, Mérida, Yucatan, Mexico, and finally New Orleans.

Physicians who are pressed for time but who would like to attend the Santiago meeting may fly directly from New York, New Orleans, Miami, or Mexico City to Santiago.

Special itineraries will be prepared for those who wish to attend the Congress, and will be personalized to include such stops as are chosen. Dr. James T. Case, 55 East Washington Street, Chicago 2, Ill., Chairman of the Committee on International Affairs of the American College of Radiology, will be happy to assist all interested radiologists in making their plans. Because of the great demand for South American transportation during the winter months, all those who foresee a possibility of attending the Third Inter-American Congress of Radiology should write Doctor Case immediately.

TEXAS RADIOLOGICAL SOCIETY

The Thirty-sixth Annual Meeting of the Texas Radiological Society was held in Fort Worth on Jan. 7 and 8, with an attendance of some 150 radiologists from Texas and adjacent states. The guest speakers were Dr. Leo G. Rigler of Minneapolis, Dr. F. E. Templeton of Seattle, Dr. C. L. Gillies of Iowa City, Dr. Howard P. Doub of Detroit, and Dr. James F. Brailsford of Birmingham, England.

The newly elected officers of the Society are Dr. J. J. Faust of Tyler, President; Dr. Wayne V. Ramsey, Abilene, President-elect; Dr. J. R. Maxfield, Jr., Dallas, First Vice-President; Dr. R. D. Moreton, Temple, Second Vice-President; Dr. R. P. O'Bannon, Fort Worth, Secretary-Treasurer (re-elected); Dr. R. T. Wilson, Austin, Historian (re-elected). Dr. L. M. Garrett, Corpus Christi, outgoing President, became a board member succeeding Dr. Herman Klapproth.

UTAH STATE RADIOLOGICAL SOCIETY

At the recent meeting of the Utah State Radiological Society, Dr. M. Lowry Allen was elected President and Dr. Angus K. Wilson, Secretary-Treasurer.

LOWELL S. GOIN, M.D.

The appointment of Dr. Lowell S. Goin of Los Angeles to the National Advisory Cancer Council has been announced by Surgeon General Leonard A. Scheele of the Public Health Service, Federal Security Agency. In this capacity Dr. Goin will help formulate plans and policies of the National Cancer Institute and review applications from non-Federal institutions for aid in cancer control and research.

Dr. Goin, who is chief radiologist at the Queen of the Angels Hospital, Los Angeles, is a past president of the Radiological Society of North America, which also awarded him its gold medal, as well as of the American College of Radiology and of the California Medical Association.

AVAILABILITY OF LITHIUM DEUTERIDE AND LITHIUM ALUMINUM DEUTERIDE

Lithium deuteride and lithium aluminum deuteride are being synthesized by Metal Hydrides, Inc., of Beverly, Mass., and can be purchased from this source, at cost, by research organizations having need for the material. Due to the availability of these two reagents, it will now be possible to label many important inorganic and organic compounds with the heavy hydrogen isotope, H2.

Since the deuterium used by Metal Hydrides, Inc., in the production of lithium deuteride and lithium aluminum deuteride is purchased from the U. S. Atomic Energy Commission, prospective customers must obtain Commission approval before securing either compound from this company.

An inquiry regarding the availability and price of the compound desired should first be directed to Metal Hydrides, Inc., 12–24 Congress Street, Beverly, Mass. A formal request to the Commission to use either lithium deuteride or lithium aluminum deuteride should then be made on AEC Form 100, "Stable Isotope Request," and submitted to the U. S. Atomic Energy Commission, P. O. Box E, Oak Ridge Operations, Oak Ridge, Tenn. Attention: Isotopes Division. Blank Form 100 may be obtained from either Metal Hydrides, Inc., or the Isotopes Division. Under Item 7, Form 100, the quantity required for the investigation should be given in terms of weight in grams of lithium deuteride or lithium aluminum deuteride, not of deuterium.

As soon as an allocation approval is made, both applicant and Metal Hydrides, Inc., will be notified. The applicant may then forward his purchase order to Metal Hydrides, Inc., and arrange for shipment.

Information concerning lithium deuteride and lithium aluminum deuteride is contained in Isotopes Division Circular E-34, issued by the U. S. Atomic Energy Commission (Isotopes Division, Oak Ridge Operations). Details not covered in the circular may

be obtained by writing to Metal Hydrides, Inc., and asking for the data sheet on "Lithium Aluminum Deuteride."

Books Received

Books received are acknowledged under this heading, and such notice may be regarded as recognition of the courtesy of the sender. Reviews will be published in the interest of our readers and as space permits.

CANCER OF THE ESOPHAGUS AND GASTRIC CARDIA. Edited by GEORGE T. PACK, B.S., M.D., New York, N. Y., Clinical Professor of Surgery, New York Medical College; Attending Surgeon, the Memorial Hospital for Cancer and Allied Diseases. A volume of 192 pages, with numerous illustrations and tables. Published by C. V. Mosby Co., St. Louis, Mo., 1949. Price $5.00.

PRACTICAL SPECTROSCOPY. By GEORGE R. HARRISON, PH.D., SC.D., Professor of Physics, RICHARD C. LORD, PH.D., Associate Professor of Chemistry, and JOHN R. LOOFBOUROW, SC.D., Professor of Biophysics, of the Spectroscopy Laboratory, Massachusetts Institute of Technology. A volume of 606 pages, with numerous illustrations and tables. Published by Prentice-Hall, Inc., New York 11, N. Y., 1948. Price $6.65.

BIOLOGICAL REACTIONS CAUSED BY ELECTRIC CURRENTS AND BY X-RAYS. A THEORETICAL STUDY OF THE PHENOMENA OF EXCITATION IN THE NERVE BY DIFFERENT ELECTRIC CURRENTS AND OF THE BIOLOGICAL REACTIONS CAUSED BY X-RAYS, BOTH BASED UPON A COMMON PRINCIPLE. By J. TH. VAN DER WERFF, M.D., D.Sc., Radiologist of the St. Canisius Hospital, Nÿmegen, Netherlands. A volume of 204 pages, with 38 illustrations. Published by the Elsevier Publishing Co., New York, Amsterdam, London, Brussels, 1948. Price $5.00.

LUNG DUST LESIONS (PNEUMOCONIOSIS) VERSUS TUBERCULOSIS. By LEWIS GREGORY COLE, M.D., F.R.C.R. A volume of 474 pages, with 349 illustrations. Published by American Medical Films, Inc., White Plains, N. Y., 1948. Price $10.00.

KREBSMETASTASEN. By DR. HANS E. WALTHER, Chief of the Roentgen Division of the Red Cross Hospital in Zürich, with a foreword by PROF. DR. H. VON MEYENBURG, Director of the Pathological Institute in Zürich. A volume of 560 pages, with 359 illustrations. Published by Benno Schwabe & Co., Basel, Switzerland. Imported by Grune & Stratton, Inc., New York.

Book Reveiws

RADON: ITS TECHNIQUE AND USE. By W. A. JENNINGS, B.Sc., A. INST. P., Physicist to the Royal Northern Hospital and Prince of Wales's General Hospital Joint Radiotherapy Centre, and, S. RUSS, C.B.E., D.Sc., F. INST. P., formerly Physicist to the Middlesex Hospital, London. A volume of 222 pages, with numerous illustrations. Published for The Middlesex Hospital Press by John Murray, Albemarle St., London, W.1, 1948. Price 18*s*. net.

The authors have written a very informative book on the subject of radon, intended primarily as a source of reference. Not only is it probably the most complete collection of information published to date on this subject, but it is pleasant reading and its excellent illustrations, examples, and figures make it relatively easy to understand. Numerous formulae with explanations of their derivation are included, as well as useful nomograms and tables for dosage calculations. For ease of use, the tables are placed at the end of the text.

The book is conveniently divided into three parts. In the first, the basic principles of radium and atomic disintegration are discussed. The production, general properties, and measurement of radon are described. Part II sets forth with great detail the technical aspects of the production of radon, its extraction and purification, the preparation of seeds and needles, and measurement of their gamma ray activity. A complete description of the radon plant is given, along with detailed instructions for its operation. Part III consists of a discussion of radon in medicine. This deals chiefly with the physical aspects of treatment planning and is essentially a presentation of previously published work by Paterson and Parker and C. W. Wilson. Of special interest to radiation therapists will be the description of a new technic for interstitial implantation, the seed-chain implant. This method consists in the use of chains of radon seeds joined together by a pair of strong but fine silk threads. A curved cannula is inserted through the tissue and the seeds are drawn through it. The cannula is then withdrawn, leaving the seeds in place. The flexibility of seed-chains makes them easily adaptable to contours where rigid, straight needles would be unsatisfactory. In application to curved surfaces and mobile organs, this method has a real advantage, and unequal loading of the individual seeds in such a chain will make for a more perfect physical distribution. Methods and examples for seed-chain plane implant dosage calculations are given.

The book concludes with a brief discussion of medical considerations, such as the choice of radon over radium, methods to improve radon seed implantation, and a tabulation of the sites in which radon may be implanted. Rules for individual protection and suggested plans for a radon center are given in the appendix.

PATHOLOGY OF TUMOURS. By RUPERT A. WILLIS. Butterworth & Co., Ltd., London, England; C. V. Mosby Co., St. Louis, Mo., U. S. A., 1948. Price $20.00.

A volume on *The Spread of Tumours in the Human Body* was published by Rupert A. Willis in 1934. In its 414 pages and 103 cuts is contained a complete survey of the subject. A very extensive bibliography is useful to anyone who wishes to consult the original articles read by the author. This book instantly became the standard text on the subject, and no one has ventured to publish anything of the sort since, as there was nothing more to be said.

It is natural therefore that, when it was announced that Dr. Willis was preparing a textbook on pathology, his admirers anxiously awaited the appearance of the new volume, and such was its welcome in this country that the first shipment to the United States was sold out in a few days. Those who were fortunate enough to obtain first edition copies have not been disappointed. It is impossible to review the book in detail. Type and paper are good, considering the difficulties met with in printing everywhere. The 500 cuts are satisfactory; some of them are extremely good, and all illustrate the text very usefully. There are long bibliographies for the benefit of the student of pathology, the more important articles being indicated by heavy-faced type. Throughout the whole volume the discussion of the subject is personal, but always interesting and valuable. An especially interesting feature is that every now and then the author stops in his description of a given group of tumors and, after quoting others, frankly states his own opinion, which usually clears the atmosphere of some of the verbal fog with which the discussion of our obscure tumors is so often surrounded.

To say that this is the best book on tumor pathology is slight praise. No other can replace it as a standard reference work. It should be in every physician's library.

In Memoriam

DR. JOSÉ FRANCISCO MERLO GÓMEZ

Word has been received of the death, on Sept. 28, 1948, of Dr. José Francisco Merlo Gómez, one of the leading radiologists of South America, for many years an active member of the military establishment of Argentina and Professor of Radiology in the Military Medical School. He was President of the First Inter-American Congress of Radiology, which convened in Buenos Aires in 1943, and Honorary President of the Second Inter-American Congress, held in Havana in 1946.

Dr. Merlo Gómez received his degree in medicine from the Faculty of the Medical School in Buenos Aires in 1912 and did postgraduate work in Europe, part of the time in Paris as an externe during World War I. He served as assistant and later as head of the radiologic service of the Hôpital de la Pitié. In Argentina he was chief of the x-ray service of the Surgical Clinic in the Hospital Nacional de Clínicas. He was a corresponding member of the Academy of Medicine of Colombia; honorary member of the American College of Radiology; Honorary President of the Inter-American College of Radiology, which he was largely instrumental in organizing; honorary member of the Cuban, Mexican, Colombian, and Peruvian radiological societies, and President of the Argentinian Society of Radiology.

Many of his colleagues in the United States will recall with pleasure the visit of Dr. Merlo Gómez and his delightful family to this country following the Havana meeting and will share the sorrow of Señora Gómez and their children. J. T. C.

RADIOLOGICAL SOCIETIES: SECRETARIES AND MEETING DATES

Editor's Note: Secretaries of state and local radiological societies are requested to co-operate in keeping this section up-to-date by notifying the editor promptly of changes in officers and meeting dates.

UNITED STATES

RADIOLOGICAL SOCIETY OF NORTH AMERICA. *Secretary-Treasurer*, Donald S. Childs, M.D., 713 E. Genesee St., Syracuse 2, N. Y.

AMERICAN RADIUM SOCIETY. *Secretary*, Hugh F. Hare, M.D., 605 Commonwealth Ave., Boston 15, Mass.

AMERICAN ROENTGEN RAY SOCIETY. *Secretary*, Harold Dabney Kerr, M.D., Iowa City, Iowa.

AMERICAN COLLEGE OF RADIOLOGY. *Secretary*, William C. Stronach, 20 N. Wacker Dr., Chicago 6, Ill.

SECTION ON RADIOLOGY, A. M. A. *Secretary*, U. V. Portmann, M.D., Cleveland Clinic, Cleveland 6, Ohio.

Alabama

ALABAMA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, W. D. Anderson, M.D., 2501 6th St., Tuscaloosa.

Arkansas

ARKANSAS RADIOLOGICAL SOCIETY. *Secretary*, Fred Hames, M.D., Pine Bluff. Meets every three months and at meeting of State Medical Society.

California

CALIFORNIA MEDICAL ASSOCIATION, SECTION ON RADIOLOGY. *Secretary*, Sydney F. Thomas, M.D., Palo Alto Clinic, Palo Alto.

LOS ANGELES RADIOLOGICAL SOCIETY. *Secretary*, Wybren Hiemstra, 1414 S. Hope St., Los Angeles 15. Meets second Wednesday of each month at County Society Bldg.

NORTHERN CALIFORNIA RADIOLOGICAL CLUB. *Secretary*, Charles E. Grayson, M.D., Medico-Dental Bldg., Sacramento 14. Meets at dinner last Monday of September, November, January, March, and May.

PACIFIC ROENTGEN SOCIETY. *Secretary*, L. Henry Garland, M.D., 450 Sutter St., San Francisco 8. Meets annually with State Medical Association.

SAN DIEGO ROENTGEN SOCIETY. *Secretary*, R. F. Niehaus, M.D., 1831 Fourth Ave., San Diego. Meets first Wednesday of each month.

X-RAY STUDY CLUB OF SAN FRANCISCO. *Secretary*, Ivan J. Miller, M.D., 49 Fourth St. Meets monthly on the third Thursday at 7:45 P.M., January to June at Lane Hall, Stanford University Hospital, and July to December at Langley Porter Clinic, University of California Hospital.

Colorado

COLORADO RADIOLOGICAL SOCIETY. *Secretary*, Mark S. Donovan, M.D., 306 Majestic Bldg., Denver 2. Meets third Friday of each month, at the Colorado School of Medicine and Hospitals.

Connecticut

CONNECTICUT STATE MEDICAL SOCIETY, SECTION ON RADIOLOGY. *Secretary*, Robert M. Lowman, M.D., Grace-New Haven Hospital, Grace Unit, New Haven. Meetings bimonthly, second Thursday.

CONNECTICUT VALLEY RADIOLOGIC SOCIETY. *Secretary*, Ellwood W. Godfrey, M.D., 1676 Boulevard, W. Hartford. Meets second Friday of October and April.

District of Columbia

RADIOLOGICAL SECTION, DISTRICT OF COLUMBIA MEDICAL SOCIETY. *Secretary*, Alfred A. J. Den, M.D., 1801 K St., N.W., Washington 6. Meets third Thursday, January, March, May, and October, at 8:00 P.M., in Medical Society Auditorium.

Florida

FLORIDA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, F. K. Hurt, M.D., Riverside Hospital, Jacksonville. Meets in April and in November.

Georgia

GEORGIA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Robert Drane, M.D., De Renne Apartments, Savannah. Meets in November and at the annual meeting of State Medical Association.

Illinois

CHICAGO ROENTGEN SOCIETY. *Secretary*, T. J. Wachowski, M.D., 310 Ellis Ave., Wheaton. Meets at the Palmer House, second Thursday of October, November, January, February, March, and April, at 8:00 P.M.

ILLINOIS RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, William DeHollander, M.D., St. Johns' Hospital, Springfield. Meetings quarterly as announced.

ILLINOIS STATE MEDICAL SOCIETY, SECTION ON RADIOLOGY. *Secretary*, Harold L. Shinall, M.D., St. Joseph's Hospital, Bloomington.

Indiana

INDIANA ROENTGEN SOCIETY. *Secretary-Treasurer*, William M. Loehr, M.D., 712 Hume-Mansur Bldg., Indianapolis 4. Annual meeting in May.

Iowa

IOWA X-RAY CLUB. *Secretary*, Arthur W. Erskine, M.D., 326 Higley Building, Cedar Rapids. Meets during annual session of State Medical Society.

Kansas

KANSAS RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Anthony F. Rossitto, M.D., Wichita Hospital, Wichita. Meets annually with State Medical Society.

Kentucky

KENTUCKY RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Sydney E. Johnson, M.D., 101 W. Chestnut St., Louisville.

LOUISVILLE RADIOLOGICAL SOCIETY, *Secretary-Treasurer*, Everett L. Pirkey, Louisville General Hospital, Louisville 2. Meets second Friday of each month at Louisville General Hospital.

Louisiana

LOUISIANA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Johnson R. Anderson, M.D., No. Louisiana Sanitarium, Shreveport. Meets with State Medical Society.

ORLEANS PARISH RADIOLOGICAL SOCIETY. *Secretary*, Joseph V. Schlosser, M.D., Charity Hospital of Louisiana, New Orleans 13. Meets first Tuesday of each month.

SHREVEPORT RADIOLOGICAL CLUB. *Secretary*, Oscar O. Jones, M.D., 2622 Greenwood Road. Meets monthly September to May, third Wednesday.

Maryland

BALTIMORE CITY MEDICAL SOCIETY, RADIOLOGICAL SECTION. *Secretary*, J. Howard Franz, M.D., 1127 St. Paul St., Baltimore 2.

Michigan

DETROIT X-RAY AND RADIUM SOCIETY. *Secretary-Treasurer*, George Belanger, M.D., Harper Hospital, Detroit 1. Meetings first Thursday, October to May, at Wayne County Medical Society club rooms.

MICHIGAN ASSOCIATION OF ROENTGENOLOGISTS. *Secretary-Treasurer*, R. B. MacDuff, M.D., 220 Genesee Bank Building, Flint 3.

Minnesota

MINNESOTA RADIOLOGICAL SOCIETY. *Secretary*, C. N. Borman, M.D., 802 Medical Arts Bldg., Minneapolis 2. Meets in Spring and Fall.

Missouri

RADIOLOGICAL SOCIETY OF GREATER KANSAS CITY. *Secretary*, Wm. M. Kitchen, M.D., 1010 Rialto Building, Kansas City 6, Mo. Meetings last Friday of each month.

ST. LOUIS SOCIETY OF RADIOLOGISTS. *Secretary*, Edwin C. Ernst, M.D., 100 Beaumont Medical Bldg. Meets on fourth Wednesday, October to May.

Nebraska

NEBRASKA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Ralph C. Moore, M.D., Nebraska Methodist Hospital, Omaha 3. Meets third Wednesday of each month at 6 P.M. in Omaha or Lincoln.

New England

NEW ENGLAND ROENTGEN RAY SOCIETY. *Secretary-Treasurer*, George Levene, M.D., Massachusetts Memorial Hospitals, Boston. Meets monthly on third Friday at Boston Medical Library.

New Hampshire

NEW HAMPSHIRE ROENTGEN SOCIETY. *Secretary-Treasurer*, Albert C. Johnston, M.D., Elliot Community Hospital, Keene. Meetings quarterly in Concord.

New Jersey

RADIOLOGICAL SOCIETY OF NEW JERSEY. *Secretary*, Raphael Pomeranz, M.D., 31 Lincoln Park, Newark 2. Meetings at Atlantic City at time of State Medical Society and midwinter in Newark.

New York

ASSOCIATED RADIOLOGISTS OF NEW YORK, INC. *Secretary*, William J. Francis, M.D., East Rockaway.

BROOKLYN ROENTGEN RAY SOCIETY. *Secretary-Treasurer*, Abraham H. Levy, M.D., 1354 Carroll St., Bklyn. 13. Meets fourth Tuesday of each month, October to April.

BUFFALO RADIOLOGICAL SOCIETY. *Secretary-Treasurer*. Mario C. Gian, M.D., 610 Niagara St., Buffalo 1. Meetings second Monday, October to May.

CENTRAL NEW YORK ROENTGEN SOCIETY. *Secretary-Treasurer*, Dwight V. Needham, M.D., 608 E. Genesee St., Syracuse 10. Meetings in January, May, and October.

LONG ISLAND RADIOLOGICAL SOCIETY. *Secretary*, Marcus Wiener, M.D., 1430 48th St., Brooklyn 19. Meetings fourth Thursday evening, October to May, at 8:45 P.M., in Kings County Medical Bldg.

NEW YORK ROENTGEN SOCIETY. *Secretary*, Wm. Snow, M.D., 941 Park Ave., New York 28.

QUEENS ROENTGEN RAY SOCIETY. *Secretary*, Jacob E. Goldstein, M.D., 88-29 163rd St., Jamaica 3. Meets fourth Monday of each month.

ROCHESTER ROENTGEN-RAY SOCIETY. *Secretary-Treasurer*, Ralph E. Alexander, M.D., 101 Medical Arts Bldg., Rochester 7. Meets at Strong Memorial Hospital, third Monday, September through May.

North Carolina

RADIOLOGICAL SOCIETY OF NORTH CAROLINA. *Secretary-Treasurer*, James E. Hemphill, M.D., Professional Bldg., Charlotte 2. Meets in May and October.

North Dakota

NORTH DAKOTA RADIOLOGICAL SOCIETY. *Secretary*, Charles Heilman, M.D., 1338 Second St., N., Fargo.

Ohio

OHIO STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Carroll Dundon, M.D., 2065 Adelbert Road, Cleveland 6. Next meeting at annual meeting of the State Medical Association.

CENTRAL OHIO RADIOLOGICAL SOCIETY. *Secretary*, Paul D. Meyer, M.D., Grant Hospital, Columbus. Meets second Thursday, October, December, February, April, and June, 6:30 P.M., Seneca Hotel, Columbus.

CINCINNATI RADIOLOGICAL SOCIETY. *Secretary*, Eugene L. Saenger, M.D., 735 Doctors Bldg., Cincinnati 2. Meets last Monday, September to May.

CLEVELAND RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, George L. Sackett, M.D., 10515 Carnegie Ave., Cleveland 6. Meetings at 6:30 P.M. on fourth Monday, October to April, inclusive.

Oklahoma

OKLAHOMA STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, W. E. Brown, M.D., 21st and Xanthus, Tulsa 4. Meets in October, January, and May.

Oregon

OREGON RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Boyd Isenhart, M.D., 214 Medical-Dental Bldg., Portland 5. Meets monthly, on the second Wednesday, at 8:00 P.M., in the library of the University of Oregon Medical School.

Pacific Northwest

PACIFIC NORTHWEST RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Sydney J. Hawley, M.D., 1320 Madison St., Seattle 4, Wash. Meets annually in May.

Pennsylvania

PENNSYLVANIA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, James M. Converse, M.D., 416 Pine St., Williamsport 8. Meets annually.

PHILADELPHIA ROENTGEN RAY SOCIETY. *Secretary*, Arthur Finkelstein, M.D., Graduate Hospital, Philadelphia. Meets first Thursday of each month at 8:00 P.M., from October to May, in Thomson Hall, College of Physicians, 21 S. 22d St.

PITTSBURGH ROENTGEN SOCIETY. *Secretary-Treasurer*, R. P. Meader, M.D., 4002 Jenkins Arcade, Pittsburgh 22. Meets second Wednesday of each month at 6:30 P.M., October to June.

Rocky Mountain States

ROCKY MOUNTAIN RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Maurice D. Frazer, M.D., Lincoln Clinic, Lincoln, Nebr. Next meeting in Denver, Colo., Aug. 18–20, 1949.

South Carolina

SOUTH CAROLINA X-RAY SOCIETY. *Secretary-Treasurer*, Robert B. Taft, M.D., 103 Rutledge Ave., Charleston 16.

Tennessee

MEMPHIS ROENTGEN CLUB. Meetings second Tuesday of each month at University Center.

TENNESSEE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, J. Marsh Frére, M.D., 707 Walnut St., Chattanooga. Meets annually with State Medical Society in April.

Texas

DALLAS-FORT WORTH ROENTGEN STUDY CLUB. *Secretary*, X. R. Hyde, M.D., Medical Arts Bldg., Fort Worth 2. Meetings on third Monday of each month in Dallas in the odd months and in Fort Worth in the even months.

HOUSTON X-RAY CLUB. *Secretary*, Curtis H. Burge, M.D., 3020 San Jacinto, Houston 4. Meetings fourth Monday of each month.

TEXAS RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, R. P. O'Bannon, M.D., 650 Fifth Ave., Fort Worth.

Utah

UTAH STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Angus K. Wilson, M.D., 343 S. Main St., Salt Lake City. Meets third Wednesday, January, March, May, September, November.

Virginia

VIRGINIA RADIOLOGICAL SOCIETY. *Secretary*, P. B. Parsons, M.D., Norfolk General Hospital, Norfolk 7.

Washington

WASHINGTON STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Homer V. Hartzell, M.D., 310 Stimson Bldg., Seattle 1. Meetings fourth Monday, October through May, at College Club, Seattle.

Wisconsin

MILWAUKEE ROENTGEN RAY SOCIETY. *Secretary-Treasurer*, Theodore J. Pfeffer, M.D., 839 N. Marshall St., Milwaukee 2. Meets monthly on second Monday at the University Club.

RADIOLOGICAL SECTION OF THE WISCONSIN STATE MEDICAL SOCIETY. *Secretary*, S. R. Beatty, M.D., 185 Hazel St., Oshkosh. Two-day meeting in May and one-day with State Medical Society, September.

UNIVERSITY OF WISCONSIN RADIOLOGICAL CONFERENCE. Meets first and third Thursdays 4 P.M., September to May, Service Memorial Institute, Madison 6.

Puerto Rico

ASOCIACIÓN PUERTORRIQUEÑA DE RADIOLOGÍA. *Secretary*, Jesús Rivera Otero, M.D., Box 3542, Santurce, Puerto Rico.

CANADA

CANADIAN ASSOCIATION OF RADIOLOGISTS. *Honorary Secretary-Treasurer*, E. M. Crawford, M.D., 2100 Marlowe Ave., Montreal 28, Quebec. Meetings in January and June.

LA SOCIÉTÉ CANADIENNE-FRANÇAISE D'ELECTROLOGIE ET DE RADIOLOGIE MÉDICALES. *General Secretary*, Origéne Dufresne, M.D., Institut du Radium, Montreal. Meets third Saturday each month.

CUBA

SOCIEDAD DE RADIOLOGÍA Y FISIOTERAPIA DE CUBA. Offices in Hospital Mercedes, Havana. Meets monthly.

MEXICO

SOCIEDAD MEXICANA DE RADIOLOGÍA Y FISIOTERAPIA, *General Secretary*, Dr. Dionisio Pérez Cosío Marsella 11, México, D. F. Meetings first Monday of each month.

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ROENTGEN DIAGNOSIS

THE HEAD AND NECK

Sella Turcica in Obesity in Children. Hans-Olof Mossberg. Acta paediat. **35** (Supp. I): 129–140, March 1, 1948.

There is still a great difference of opinion concerning the relationship of the size of the sella to the size of the pituitary. If a relationship does exist, the next hypothesis is that a large pituitary indicates hyperfunction and a small pituitary hypofunction.

The author studied a group of normal children and a series of obese children, in a Stockholm hospital, treated before 1944 and subsequently re-examined. X-ray studies of the sella were made in 136 cases, and its profile surface was obtained by Haas' method (Fortschr. d. Röntgenstrahlen **33:** 419, 1925). The cases of obesity are classified as exogenous and endogenous.

Findings indicate that in the exogenous cases, in which the patient gained weight before the age of five years or else became obese following illness, the sella is close to the lower normal limits. In the endogenous cases of the Fröhlich type, the sella is small. In 15 endogenous cases the size was below average in 11, and in 3 of these the measurements were pathologically low.

It is believed that small sellas are common in obese children and that this may indicate hypofunction of the pituitary. This may occur in the exogenous group because the pituitary is a metabolic regulator and is insufficient in these cases to respond to the body's augmented demands of raised oxidation in the presence of such factors as increased food intake and rest in bed.

Two tables; 6 charts. EUGENE KUTZ, M.D.
Baltimore (Md.) City Hospitals

Pneumoencephalographic Diagnosis in the Presenile Dementias. Paul Chodoff, Alexander Simon, and Walter Freeman. Am. J. Roentgenol. **59:** 311–317, March 1948.

The authors review the conflicting opinions in the literature on the value of air studies in the differentiation of Pick's and Alzheimer's diseases. Nine cases of presenile dementia, 8 of which came to autopsy, are then reported. The x-ray findings were consistent throughout, showing symmetrical or asymmetrical dilatation of the lateral ventricles with or without the presence of large collections of air in the subarachnoid spaces. Five cases were diagnosed pathologically as Alzheimer's disease, one as Pick's disease, and 2 were some obscure degenerative process which did not fit the picture of either of the other two conditions.

Thus it was concluded that, although the encephalographic findings would not permit a differentiation of the various forms of presenile dementia (certainly an academic point), they would allow one to make the general diagnosis of the condition and, of course, exclude space-occupying lesions and functional psychoses.

Eight roentgenograms. ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Pantopaque Myelography in the Diagnosis of the Arnold-Chiari Malformation Without Concomitant Skeletal or Central Nervous System Defects. Bernard S. Epstein. Am. J. Roentgenol. **59:** 359–364, March 1948.

A case is reported in which there was protrusion of the cerebellum downward through the foramen magnum without platybasia or fusion of the upper cervical spine. Myelography showed a bilateral filling defect, concave caudally, in the upper cervical area, with a cleft between the two portions of the defect. The basal cisterns were also distorted. The myelograms are reproduced but their interpretation would have been clearer if diagrammatic drawings had been included.

It is important that this condition be recognized preoperatively so that an approach is not made for a cerebellar tumor, since the symptoms are closely similar. If myelography is done, the diagnosis should be made easily if the condition is kept in mind.

Seven roentgenograms; 2 drawings.
ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Angio-Epithelioma of the Postnasal Space. A. E. Cruthirds. Ann. Otol., Rhin., & Laryng. **57:** 230–234, March 1948.

This paper should presumably have been entitled *Angio-Endothelioma of the Postnasal Space*, or perhaps, in view of the course, *Angiosarcoma*. The patient was a four-year-old boy with rather sudden development of cyanosis and dyspnea. A swelling in the right side of the throat was interpreted as a peritonsillar abscess but yielded no pus on puncture. Subsequently a hard nodular mass was removed from the right pharynx, and was described histologically as an endothelioma, presumably arising from the buccal mucosa of the soft palate. Eight x-ray treatments were given and further irradiation was planned. Whether or not this was carried out is not stated, nor are any details furnished as to the original treatment.

Roentgenograms of the chest, obtained at the time of examination, in June 1944, showed no metastases, but on Nov. 16, a recheck demonstrated large metastatic areas. Further metastases also appeared in the abdomen and the patient died shortly thereafter, about seven months after the first symptoms.

Angio-endothelioma of the nasopharynx (composed of blood vessels in the early stage of formation) is fairly rare. Since most of the cases do not present symptoms referable to the nose and throat until quite late, it is important that a thorough examination be made of the nasopharynx in the presence of even slight nasal obstruction or pain about the head and neck. Particular attention should be given the postnasal space, sometimes called the "forgotten space."

Due to the anatomic situation of these lesions, they are difficult to treat. Formerly the most satisfactory response was obtained from irradiation in the form of radium packs applied externally about the neck and head and radium tubes inserted in the nasopharyngeal growth. More recently Figi has used fractionated roentgen therapy (J. A. M. A. **115:** 665, 1940).

One roentgenogram. STEPHEN N. TAGER, M.D.
Urbana, Ill.

Roentgen Diagnosis of Fluid in the Frontal and Sphenoidal Sinuses. Dag Turesson. Acta radiol. **29:** 215–220, March 31, 1948.

By adding a horizontal shelf to a Lysholm head unit with the Bucky grid upright, lateral and axial views can

be made with the x-ray beam horizontal. Fluid levels can thus be demonstrated in the sphenoid sinus. The same set-up is used for postero-anterior views with the head erect and on one side, to demonstrate shifting levels in the frontal sinuses. If nearly all the air in the frontal sinuses is replaced, a shifting air bubble is seen instead of a straight fluid level.

Eight roentgenograms; 3 photographs.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Phlebolith of the Anterior Facial Vein. Case Report. James L. McCrory and Morris Davidson. Ann. Otol., Rhin. & Laryng. **57:** 201–206, March 1948.

Phleboliths occur rarely in the region of the head and neck. The authors report a case in which small areas of calcification demonstrated roentgenologically in the soft tissues inferior to the angle of the mandible on the left were interpreted as calculi in the submaxillary gland. Operation was undertaken, but palpation of the exposed gland and duct revealed no evidence of stones. Because of extensive mobilization, the duct was followed to the floor of the mouth and ligated and the gland was removed. On further exploration, a large irregular venous space was discovered in the course of the anterior facial vein, measuring roughly 5 × 3 cm. Lying within this space and extending forward from the anterior border of the masseter muscle were several round hard bodies from 6 to 8 mm. in diameter. After evacuation of what appeared to be a fairly recent large thrombus, the sac and the calculi, which were embedded in a fibrous network, were removed in one piece. The wound was completely closed in two weeks and the pain and swelling of which the patient had complained for years were entirely relieved. On section, the stones showed a lamellated structure.

Phleboliths must be taken into consideration in the diagnosis of submaxillary calculi.

One roentgenogram; 2 photomicrographs.

STEPHEN N. TAGER, M.D.
Urbana, Ill.

Laminagraphy in the Diagnosis of Uncommon Diseases of the Skeleton of the Larynx. (a) Luxation of the Arytenoid Cartilage; (b) Crico-Arytenoid Arthritis; (c) Dislocation of the Thyroid Cartilage. Franco Hueber and Clemente Gaja. Radiol. med. (Milan) **34:** 129–138, March 1948. (In Italian.)

The authors report 3 cases, listed in the title, in which laminagraphy helped in the diagnosis. The diagnostic criteria which they employed are described.

Seven roentgenograms.

CESARE GIANTURCO, M.D.
Urbana, Ill.

THE CHEST

Incipiency and Evolution of Pulmonary Tuberculosis. I. The Initial Manifestations of the Disease. II. The Behavior of the Initial Lesion and Course of the Disease During Observation Period. David Reisner. Am. Rev. Tuberc. **57:** 207–253, March 1948.

The incipient manifestations of pulmonary tuberculosis were studied in a group of 344 cases. The majority of the persons included were contacts who had been under observation, receiving routine chest x-ray examinations at periodic intervals. In 248 cases the initial lesion was demonstrated within a period ranging from one to twelve months after a previous normal roentgenogram, and in the remainder the interval was longer than one year. The data are presented in the form of tables and charts showing the location of the lesions, their character at the time of initial examination, the stage of the disease, and the age and sex distribution. The findings from this study suggest that the early manifestation of pulmonary tuberculosis is usually a lesion of a predominantly exudative pneumonic character, varying in extent from a small localized focus to a massive pneumonic involvement in extreme cases. Lesions of the latter type were observed much more often in the non-white than in the white patient. The early lesion of limited extent usually was a localized small area of soft infiltration with ill defined and flocculent appearances. Circumscribed infiltrates were observed in only a small proportion of the cases. In about 90 per cent of the series the initial lesion was located in the upper third of the lung field. While the subclavicular region was the more common site in an appreciable proportion of the cases, the first lesion appeared in the supraclavicular area. The present observations confirm the general experience that the great majority of patients with early minimal tuberculosis have no symptoms and that the only method available for detection of the truly incipient tuberculous lesion is routine chest examination at periodic intervals.

The further evolution of the disease was studied over a period of years varying from two to ten. The majority of the patients were observed over the longer period of time, the average observation period being three and a half years. It was found that these early lesions were practically always unstable and that they exhibited a great tendency to progression. The rate of frank progression was greater in the non-white patients.

There is apparently no way of predicting the subsequent evolution of the incipient minimal lesion other than by actual observation of its behavior over a considerable period of time. The age of the patient, the location, and the roentgenologic appearance of the lesion could not be regarded as dependable guides for estimating the relative risk of progressive disease. It would seem that the majority of cases of advanced and destructive forms of pulmonary tuberculosis have their origin in these early minimal lesions.

L. W. PAUL, M.D.
University of Wisconsin

Eradicating Tuberculosis in Rural Minnesota. Lewis S. Jordan. Dis. of Chest **14:** 261–268, March-April 1948.

In 1930 the Riverside Sanatorium district of Minnesota, an area of 3,800 square miles, was selected as a testing site for a tuberculosis control program. Within this area were 27 small cities and towns, and approximately 265 rural schools.

The control program included (1) finding of infected children and observing them throughout their school career into adulthood; (2) seeking the sources of infection for each child who reacted to tuberculin; (3) eliminating the infective factor; (4) examination of all known adult contacts; (5) institution of an educational program; (6) institution of a follow-up program with periodic x-ray examinations of the chest; (7) obtaining co-operation from the local and state medical societies; and (8) aiding the veterinarian program of eradicating bovine tuberculosis.

Over 50,000 children were tested and the percentage of tuberculin reactors found decreased as the years passed. From 1930 to 1934 an average of 13.9 per cent of the children reacted to tuberculin. In 1946 and 1947 this figure had fallen to 2.7 per cent. Of 277 schools in this district there were 219 in which no child was found to react to tuberculin in 1946 and 1947. In those school areas tuberculosis has been eradicated at that age level.

In areas where there is a low incidence of tuberculosis, tuberculin testing should be done first, and the x-ray examination limited to the reactors. Most cases of pulmonary tuberculosis of the future will develop among the positive reactors of today.

The author is opposed to BCG vaccination in rural Minnesota because it would artificially sensitize the tissues and destroy the value of a potent weapon, the tuberculin test.

HENRY K. TAYLOR, M.D.
New York, N. Y.

Experience in Zurich with Canton-Wide Photoroentgen Study of Over 65,000 Cases Investigated and Diagnosed. A Study in Preventive Medicine. F. K. Fischer and H. R. Schinz. Schweiz. med. Wchnschr. **78:** 217–220, March 13, 1948. (In German.)

The authors report a chest survey conducted in the canton of Zurich, comprising 79,570 satisfactory examinations. In 64,764, or 81.4 per cent, the findings were negative, while 14,806 or 18.6 per cent showed disease. The latter figure includes 343 instances of grave disease, 3,899 relatively significant findings, and 10,564 minor incidental abnormalities. Of the whole series, 65,526 examinations were made with a photoroentgen unit; 2,823 instances of pathological findings other than minor incidental abnormalities were observed. Follow-up on these was attempted; 291 of the number could not be followed, 850 proved on more complete examination to have no significant disease, and 1,682 were shown to have disease as diagnosed. The authors stress the importance of such surveys and the role of the photoroentgen unit in their conduct.

One map; 4 tables.

LEWIS G. JACOBS, M.D.
Oakland, Calif.

Bronchography in Bronchiectasis in Children. E. Lamonte Gann. Ann. Otol., Rhin., & Laryng. **57:** 153–162, March 1948.

Once bronchiectasis is established, it is irreversible. If not too widespread, it is a surgically curable disease. Before treatment is instituted, however, not only must the existence of the disease process be established but its extent and location must be accurately determined. For confirmation of the diagnosis and accurate localization, chief reliance is to be placed on the bronchogram. Bronchoscopy, though it is essential and may yield information strongly presumptive of a diagnosis, is rarely conclusive. It is seldom indeed that one can see dilatation of a bronchus through the bronchoscope.

At the Johns Hopkins Hospital, from which this report comes, the diagnosis of bronchiectasis in children and their preparation for operation are the combined responsibility of the pediatrician, the otolaryngologist, and the radiologist. After completion of the preliminary work-up, including a thorough history, physical examination, ear, nose, and throat consultation, and routine chest roentgenography, bronchoscopy is done, as only in this way can the presence of an obstructive lesion be determined. For satisfactory bronchograms, it is essential that the bronchi be cleared of secretion. To this end, postural drainage is instituted, penicillin is administered orally and in the form of an aerosol, and bronchoscopic aspiration is performed, repeatedly if necessary. Bronchograms are customarily made in the afternoon, the child having received nothing by mouth during the preceding six hours. Approximately one and one-half hours prior to the operation, one of the barbiturates is given, followed, on call to the bronchography room, by atropine and morphine sulfate, though this preoperative medication may be omitted under certain conditions. The catheter technic and local anesthesia are used as in adults.

Following passage of the nasal catheter, the child is placed on the tilt-table under the fluoroscope and the level of the catheter is first checked. Satisfactory filling may be obtained with the tip of the catheter just above the level of the carina. It should not be pushed down into either main bronchus. The progress of the filling is watched under the fluoroscope. All lobes of both lungs are mapped at one sitting. On an average, 15 c.c. of iodized oil are used for each patient. Anteroposterior and both right and left anterior oblique views are taken routinely.

Fifteen roentgenograms.

STEPHEN N. TAGER, M.D.
Urbana, Ill.

Chronic Benign Pneumonitis. Its Discovery in Older Individuals with Diminished or Absent Gag Reflex. Louis Schneider. New York State J. Med. **48:** 520–522, March 1, 1948.

Schneider reports 3 cases in which he observed unchanging densities in the lower lung field in older patients with absent or diminished gag reflex. One of the number was a chronic user of mineral oil, and another had used oily nose drops over a long period of time. The lung shadows remained unchanged over a period of several months and there was a sparsity of physical signs, with no respiratory symptoms. It is concluded that both cases represented oil pneumonitis, though neither patient would submit to bronchoscopic study. Schneider suggests that oil pneumonitis should be considered in older individuals with impaired gag reflex who present densities in the lower lung fields but emphasizes the necessity of further study to rule out carcinoma of the lung. He feels that the increasing use of chest surveys may elicit more cases of a similar nature.

Four roentgenograms.

ROBERT C. PENDERGRASS, M.D.
Americus, Ga.

Benign Pneumoconiosis Due to Tin Oxide. A Case Report with Experimental Investigation of the Radiographic Density of the Tin Oxide Dust. Eugene P. Pendergrass and Arthur W. Pryde. J. Indust. Hyg. & Toxicol. **30:** 119–123, March 1948.

A case is reported of a 45-year-old man who bagged tin oxide for fifteen years. The tin oxide was nearly pure and no silica was found in the sample analyzed. The patient had had no previous exposure to industrial dusts. He had no disability, although the domes of the diaphragm scarcely moved as observed fluoroscopically. Chest films showed discrete densities throughout both lungs, especially in the upper two-thirds, denser than

those seen in silicosis. Considerable opaque material was also present in the hilar lymph nodes. The lungs were emphysematous, but no unusual fibrous tissue formation was seen surrounding the dense spots or distributed between them.

Experimental studies of the radiographic density of tin oxide were made to see if the tin dust might account for the shadows seen in the roentgenogram. It was found that even small amounts of tin oxide will of themselves, without associated fibrosis, produce densities of an appreciable degree within the lung.

In view of the absence of a silica exposure in the case reported and the results of the experimental studies, the authors believe that the changes in the lung are the pseudo-nodulation of a benign non-specific pneumoconiosis. The case should serve as a reminder that the lung is the recipient of much particulate matter which may produce shadows on a roentgenogram simulating those of silicosis. A careful history will often be of assistance in making the correct interpretation. Actually the nodular opacities are greater in degree than those found in uncomplicated silicosis and resemble more closely those of baritosis.

Four roentgenograms.

Pneumoconiosis Due to Talc in the Cosmetic Industry. Nathan Millman. Occup. Med. **4:** 391–394, October-November-December 1947.

A case of generalized pneumoconiosis of a nodular type in a fifty-five-year-old man with a twenty-four year history of exposure to talc in the cosmetic industry is reported.

One roentgenogram.

Poisoning with Nitrous Gases from Explosive Bombs (A Clinicoroentgenologic and Anatomic Contribution). H. Franke, W. Krauland, and E. Ruckensteiner. Schweiz. med. Wchnschr. **78:** 256—260, March 20, 1948.

Poisoning from explosive (as distinguished from gas-containing) bombs is due to the nitrous fumes emitted and usually occurs only where the fumes are confined, as in a room. The cases reported followed explosion of a bomb in a room adjacent to one 4 × 4 meters in size, in which 16 people were present. Most of them took in a deep breath and donned gas masks at command but several of the women were unconscious for a few minutes. The group was confined in this room from forty to sixty minutes.

Clinical findings were present in from 8 to 10 people, the picture showing little variation. After an asymptomatic interval of varying length, an irritative cough appeared, accompanied by severe dyspnea, pale cyanosis, and the clinical and roentgen picture of pulmonary edema. The blood showed hemoconcentration and leukocytosis. The circulatory system showed signs commensurate with the pulmonary changes, up to the point of circulatory collapse. Either death or gradual recovery, with slow resolution of the x-ray signs over a period of months, may ensue.

The x-ray picture varies, but the most severe cases show a patchy or miliary infiltration of both lungs with a tendency to confluence. The changes are for the most part symmetrically distributed. These infiltrates gradually disappear as recovery takes place, with clearing toward the hili; these may be indistinguishable in the presence of severe changes. Atelectasis may occur in the more acute stages. While the signs described might represent either edema or an acute bronchiolitis, autopsy studies favor the former view. The findings are very similar to those described by Nichols after the Cleveland Clinic disaster (Am. J. Roentgenol. **23:** 516, 1930).

Four roentgenograms; 1 photomicrograph; 1 graph.

LEWIS G. JACOBS, M.D.
Oakland, Calif.

Pulmonary Aspergillosis: Report of Two Cases. B. Gerstl, William H. Weidman, and Abbot V. Newmann. Ann. Int. Med. **28:** 662–671, March 1948.

The first of the two cases reported here may be interpreted as a bronchiectatic cyst harboring a growth of aspergillus. The mycotic infection did not invade the surrounding parenchyma or vessels, though some inflammatory reaction was present. The failure of the fungus to migrate into the surrounding tissue and the histology of the cavity wall led to the assumption that the cavity was preformed and did not result from propagation of the fungus. The interpretation of the roentgenographic changes in this patient was difficult. The early films gave no clue to the existence of a cyst. The well defined oval lesion demonstrated on later examination suggested bronchial adenoma, but additional parenchymal changes and a small aerated crescent on the upper pole raised doubt to this interpretation. Cavitation would be reconcilable with tuberculosis, but this diagnosis was undermined by the consistently negative sputum. A correct diagnosis was made following lobectomy for incapacitating recurrent hemoptyses.

In the second case the presence of lesions in other organs, revealed at autopsy, led to a diagnosis of systemic aspergillosis. The roentgen changes differed somewhat from those which have been described as suggestive of fungus disease of the lung. They resembled rather the spread and metastases of cancer and were in fact interpreted as such by several roentgenologists. These lesions developed, however, over a period of less than two months and should support a diagnosis of mycosis. The pathology underlying the roentgen-ray changes is that of a combination of interstitial and parenchymatous disease plus tissue necrosis hastened by the extensive occlusion of pulmonary vessels. The unrestricted penetration of all pulmonary structures is in striking contrast to the limited growth of the fungus in the first patient.

Four roentgenograms; 4 photomicrographs; 1 photograph.

STEPHEN N. TAGER, M.D.
Urbana, Ill.

Early Clinical Features of Bronchogenic Carcinoma: Illustrative Cases. Charles M. Norris. Dis. of Chest **14:** 198–217, March-April, 1948.

An arbitrary classification of bronchial carcinomas based on location is of more practical value for clinical study than one based on histological findings, for the early clinical manifestations depend upon the point of origin of the lesion. Tumors may arise in a main or lobar bronchus, in a segmental bronchus, or in a small or peripheral bronchus.

A carcinoma in a large bronchus usually gives rise to a chronic non-productive cough, This may undergo a change in character, and other signs and symptoms subsequently develop, depending upon the degree of obstruction which interferes with interchange of air, or

bronchial drainage, or both. As the obstruction increases, obstructive emphysema occurs, giving way to atelectasis. A wheeze may develop, which disappears when the obstruction becomes complete. Interference with drainage leads to secondary infection, with symptoms resembling the ordinary lower respiratory infections, as pneumonia, bronchitis, "flu," etc.

A carcinoma arising in a segmental bronchus soon obstructs the bronchus, and symptoms consequent to obstruction and secondary infection ensue. A roentgenographic examination will show a segmental atelectasis. Carcinoma arising in peripheral bronchi frequently attain considerable size without giving rise to pulmonary symptoms. Obstructive manifestations usually do not occur.

Case histories illustrative of the various early clinical and roentgen manifestations are included.

The author states that of 269 proved cases of bronchogenic carcinoma seen in a ten-year period, only 30, or 12.9 per cent, were found to be operable. Most cases of carcinoma of the bronchus undoubtedly pass from an operable to an inoperable stage within a short time. Early diagnosis is therefore essential. A complete study should include, in addition to the roentgen examination, a bronchoscopy with bacteriologic study of the bronchial secretions and a cytologic examination in cases in which biopsy is not obtainable. Additional procedures may be instituted when indicated, as bronchial lavage, gastric washing, skin testing, bronchography, planigraphy, bacteriologic and cytologic examination of pleural fluid, aspiration biopsy, and occasionally thoracoscopy.

In a recent analysis of 310 cases of bronchogenic carcinoma, histologic proof was obtainable in 97 per cent of the cases during life, bronchoscopically or otherwise. In 6 of this group chest films were thought to be essentially negative. This number would have been greater if there had been less delay between the onset of symptoms and the first x-ray examination. Symptoms alone may thus be sufficient indication for bronchoscopy, even though the roentgen examination shows little or no abnormality.

Twenty-five roentgenograms; 1 diagram; 2 tables.

HENRY K. TAYLOR, M.D.
New York, N. Y.

Metastatic Cancer of the Lung. Robert C. Pendergrass. J. M. A. Georgia **37:** 85–88, March 1948.

In general there are four types of metastatic involvement of the lung: (1) large nodular masses, (2) small miliary lesions, (3) linear, infiltrating strands, and (4) pleural involvement, manifested by either pleural thickening or fluid. In addition, there may be enlargement of the mediastinal lymphatic structures. The large nodular masses must be distinguished from encysted interlobar effusions, cystic lung disease, adenomatosis, and primary cancer of the lung. The miliary lesions may be confused with tuberculosis and various fungus diseases and mycoses. The linear type requires differentiation from passive congestion, lymphomatous invasion, and radiation fibrosis. In children, cystic fibrosis of the pancreas produces pulmonary lesions readily confused with metastatic cancer.

The author warns that one must be constantly on guard against assuming that any abnormal shadow appearing on radiographs of the chest, in the presence of a malignant growth elsewhere, necessarily represents a metastasis. He emphasizes, also, the importance of the recognition of metastases before carrying out major surgical or radiological procedures, as well as the importance of examination of the chest in follow-up studies of cancer patients.

Mention is made of the fact that carcinoma of the cervix occasionally metastasizes to the lung.

EDWARD E. LEVINE, M.D.
Dearborn, Mich.

Skeletal Thoracic Alterations in the Diagnosis of Pulmonary Tumors. Giovanni Gardella. Radiol. med. (Milan) **34:** 146–158, March 1948. (In Italian.)

The author has had the opportunity of studying 40 cases of lung tumor which subsequently were confirmed by surgical intervention. In 10 of these cases, he found erosions of the ribs or of other components of the thoracic skeleton. The value of these findings in the diagnosis of malignant tumor of the lung is pointed out.

Thirteen roentgenograms.

CESARE GIANTURCO, M.D.
Urbana, Ill.

Lobar Adenocarcinoma of the Lung Simulating Pneumonia. Report of Two Cases. Gertrude Silverman and Alfred Angrist. Arch. Int. Med. **81:** 369–380, March 1948.

During a period of two months, autopsy was performed in 2 cases in which the true nature of an extensive pneumonic consolidation was not clearly recognized until microscopic study revealed diffuse adenocarcinoma. In neither of the cases could a primary adenocarcinoma be found outside the lungs, nor could an exact origin from a bronchus be demonstrated.

Several points are discussed in connection with these cases: (1) Are they cases of primary adenocarcinoma of the lung or has a primary growth at some other site been overlooked? (2) If the primary site is in the lung, where is the point of origin of these tumors? Do they arise in the bronchial tree, or can they be called alveolar cell carcinomas? (3) May a theoretic origin for this tumor process exist in the well known instances of alveolar epithelization in human beings? (4) Could these tumors have multiple simultaneous points of origin? (5) What, if any, is the relationship among diffuse or nodular adenocarcinoma of the lung, pulmonary adenomatosis in human beings, induced or spontaneous pulmonary tumors in mice, and jagziekte infection in sheep?

The following conclusions are reached: (1) The growths are primary in the lung, but metastases from a latent primary glandular focus outside the lung should be carefully excluded. (2) The tumors arise from the mucosa of the bronchial tree beyond the larger bronchi, the point of origin being obscured by the extensive growth involvement. (3) A source of origin from preexisting epithelized alveoli cannot be proved. (4) A multicentric origin cannot be established. (5) To date, there is no proved relationship between diffuse adenocarcinoma of the lung and pulmonary adenomatosis.

Three roentgenograms; 2 photographs; 3 photomicrographs.

Pulmonary Adenomatosis. Report of a Case. Eugene Hildebrand. Am. Rev. Tuberc. **57:** 281–286, March 1948.

A case of pulmonary adenomatosis is presented, this being the first so far reported from Montana. The

patient was a 66-year-old woman who had lived most of her life on a large sheep ranch in Montana, where jagziekte is endemic. The patient had a non-productive cough of three months duration, and a roentgenogram of the chest revealed a shadow extending laterally from the right hilum, which led to the presumptive diagnosis of carcinoma of the lung. The cough soon became productive of clear frothy sputum and this increased in amount so that finally great quantities were expectorated. The patient became progressively dyspneic. There was no hemoptysis and no pain. Death occurred from respiratory failure about nine months after the onset of symptoms.

A brief discussion of this rare disease is given, and its possible relationship to the disease of sheep known as jagziekte is discussed. Of interest in this connection is the fact that progressive pneumonia in sheep had been endemic on the patient's ranch, and that in a sheep with signs and symptoms of the disease which had been killed shortly after the onset of her disease all lobes of the lungs were involved in the inflammatory adenomatous process.

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University of Wisconsin

Bronchiogenic Cysts of the Mediastinum. Herbert C. Maier. Ann. Surg. **127:** 476–502, March 1948.

Of the variety of cysts that occur in the mediastinum, the vast majority are congenital in origin. Bronchiogenic cysts of the mediastinum result from the faulty development of elements of the primitive foregut, and there is no sharp distinction between these cysts and those arising from the digestive tube. Most bronchiogenic cysts are found in close relationship with the trachea or main bronchi; occasionally one may be found closely associated with the esophagus or even the vertebral bodies. The misplacement of cells probably occurs at an early stage of embryonic development and the cysts gradually increase in size because of the secretion within the cavity. Occasionally one causes death in early life by compression of the trachea or main bronchi.

In general, symptoms associated with bronchiogenic cysts are the result of compression of the tracheobronchial tree. In some patients, symptoms are vague and not characteristic. In the presence of superimposed infection, the picture resembles that of intrathoracic suppuration. Cysts that do not produce symptoms in early life are frequently found by chance on routine roentgen examinations of the chest.

Bronchiogenic cysts are arbitrarily divided into five groups: (1) paratracheal, (2) carinal, (3) hilar, (4) paraesophageal, (5) miscellaneous.

Cysts of the paratracheal group must be differentiated from other masses in the upper mediastinum lying close to the trachea, as a substernal thyroid, a thymic tumor, an intrathoracic hygroma, serous cysts, and aneurysms. Radiographically the borders of the cyst tend to be more sharply defined than those of a soft-tissue mass. As contrasted with a thymic tumor, the upper limit of a cyst will usually be above the level of the clavicle.

The carinal group offers special diagnostic difficulties. The chest film may give no evidence of the cyst, which may be completely hidden in the mediastinal densities.

Cysts of the hilar group require differentiation especially from mediastinal dermoids. The former arise as a rule in the posterior mediastinum and the latter in the anterior mediastinum. Neurogenic tumors are seen on lateral films in the costovertebral portion of the thorax, while bronchiogenic cysts are in the posterior mediastinum anterior to the vertebral bodies. Bronchiogenic cysts may move with respiration and undergo a change of shape.

Paraesophageal cysts are to be distinguished from solid tumors of the esophageal wall, but this cannot always be done on the basis of the roentgen and clinical findings.

Surgical excision is usually indicated. Eight illustrative cases are reported in detail.

Fifteen roentgenograms; 3 photomicrographs; 2 photographs.

ALTON S. HANSEN, M.D.
Peoria, Ill.

The Cardiac Silhouette and Diameters in the Newborn. Agustín Castellanos and Otto García. Rev. cubana de pediat. **20:** 133–149, March 1948. (In Spanish.)

Roentgenologic measurement of the diameter and contour of the heart was performed in 50 normal newborn infants in the Maternity Hospital of Havana. As had been previously suspected, the thymic shadows prevented the accurate estimate of the cardiac size and shape in the majority of babies, where the contour of the heart could not be well outlined because of thymic enlargement. Moderate enlargement of the thymus was found in 31 cases, including 6 with hypertrophy of the right lobule, 17 with hypertrophy of the left lobule, and only 8 with enlargement of both right and left lobules. Primary enlargement of the thymic shadow was found in 6 instances, and only 16, or 32 per cent, of the total number showed no discernible thymus shadow. A pseudovascular shadow simulating an enlarged medium arch of the pulmonary artery was thought to be due chiefly to hypertrophy of the lower portion of the left thymus lobule. A false cardiac shadow due to an enlarged thymus has been erroneously interpreted as indicating idiopathic or essential hypertrophy of the heart. Shadows of this type were found in four cases.

The roentgenologic contour of the heart in the normal newborn baby shows a great deal of variation. The value of cardiac mensuration in the diagnosis of congenital heart diseases at this age is therefore rather limited, being useful only in those few cases showing a marked quantitative and qualitative deviation from the normal heart shadow seen in the absence of congenital defect.

The measurements were made according to the authors' modification of the method of Vaquez-Bordet.

Five diagrammatic drawings; 5 tables.

JAMES T. CASE, M.D.
Chicago, Ill.

Roentgen Cardiac Kymography: Electrocardiographic Correlation. S. F. Thomas and L. H. Garland. California Med. **68:** 126–129, March 1948.

Roentgen kymography provides a permanent record and analysis of cardiac motion. In this study, the multiple slit kymograph was used, with exposures of one and a half to two seconds, at 48 inches distance, made in mid-inspiration with the patient relaxed. In addition to a postero-anterior view, right and left anterior oblique views were taken.

The criteria for kymographic diagnosis are the depth, shape, and phase of the waves. While the normal figure for the depth of the waves is usually given as 4

to 8 mm., the authors found the depth to be less than 4 mm. in most cases. In disease of the myocardium the depth was decreased to 2 mm. or less. Other evidences of myocardial damage were peaking of the waves, splintering of the waves, especially when accompanied by fuzzy waves of low amplitude, absence of any motion (so-called "silent frames"), and outright reversal of movement ("paradoxical frames").

In 249 cases in which both kymograms and electrocardiograms were obtained, the two were in agreement in 201, or 80.5 per cent. From an analysis of their findings, the authors conclude that roentgen kymography is a useful method of examination of the heart and may give information not otherwise obtainable. Three illustrative cases are included: (1) a case with autopsy proof, exemplifying a typical myocardial infarct; (2) a case of myocardial infarct proved at autopsy, in which the electrocardiogram was negative but the kymogram was positive; (3) a case of stab wound of the heart in which the initial electrocardiogram showed evidence only of pericarditis while the kymogram was indicative of localized myocardial damage. In this last case the electrocardiogram subsequently became positive and eventually both the electrocardiographic and kymographic findings returned to normal.

Six kymograms; 1 table.

MAURICE D. SACHS, M.D.
Cleveland, Ohio

Diagnosis of Congenital Heart Disease. J. D. Keith. Canad. M. A. J. **58:** 247–251, March 1948.

The author has reviewed 144 postmortem records at the Hospital for Sick Children, Toronto, wherever possible correlating the x-ray and clinical findings with the observations at autopsy. To these he adds a group of cases diagnosed in the Cardiac Clinic.

The most common defect was an anomaly of the ventricular septum. This was found 88 times in the autopsy series, but only 13 times as an isolated defect. In the cases in the Cardiac Clinic it was by far the most common abnormality, occurring in 48 instances. The diagnosis of an isolated patent interventricular septum defect is usually not difficult during life. There is a loud harsh systolic murmur, heard best in the 4th left interspace close to the sternum. The patient is well and active as a rule. The heart is frequently not much enlarged. X-ray examination shows some fullness in the region of the pulmonary area and artery, with increased hilar shadows. Association with a variety of other defects makes the diagnosis more difficult.

Interauricular defects are also common postmortem findings. Seventy-seven cases showed an opening between the auricles. Many of them were in young infants and were physiological rather than pathological. An interauricular defect appeared alone in only 4 of the 77 cases. The clinical diagnosis is made chiefly by the shape of the heart as demonstrated roentgenologically. The right auricle is enlarged, and the pulmonary conus is dilated to a greater degree than is usual in the patent septum. The hilar vessel shadows show engorgement and fluoroscopically they are usually seen to pulsate considerably. A murmur may occur up along the left border of the sternum. An accurate diagnosis is not easy. Catheterization of the heart may be useful.

The diagnosis of patent ductus is made on the basis of the typical harsh machinery murmur, which is heard with maximum intensity in the pulmonary area and transmitted out toward the shoulder. The roentgenogram shows a variation in cardiac shape, but usually the pulmonary artery is full, with evidence of engorgement in the hilar area. Under the fluoroscope the hilar vessels may be seen to pulsate, as well as the pulmonary artery. Where there is a simple patency of the ductus the child is usually well and active and of good color. Where doubt exists as to the diagnosis, catheterization may be useful.

In making a diagnosis of coarctation of the aorta, palpation of the femoral artery is an important detail. The response is invariably feeble or absent in the presence of coarctation. There is usually a systolic murmur down the left border of the sternum which is equally well heard in the back. The blood pressure is higher in the arm than the leg, and the roentgenogram shows a slightly enlarged heart with absence of the aortic knob on the left.

Since Taussig has shown that the chief cause of cyanosis in congenital heart disease is an insufficient proportion of the blood passing through the lungs, it follows that the majority of cyanotic cases are candidates for the Blalock-Taussig operation. The tetralogy of Fallot is the most suitable type of case and the diagnostic criteria are set down by the author. Transposition of the great vessels, Eisenmenger's complex, isolated pulmonary stenosis, and persistent truncus arteriosus are unsuitable for operation. The differential diagnosis of these conditions is greatly helped by angiocardiography or by catheterization of the heart.

The most common types of congenital heart disease in both the cyanotic and non-cyanotic groups are discussed, and the cardinal points in diagnosis are outlined.

Nineteen roentgenograms, 4 tables.

HUGH O'NEILL, M.D.
Cleveland, Ohio

Cardiac Calcifications, Annular and Valvular (Leaflet). Charles E. Grayson. California Med. **68:** 121–125, March 1948.

A study has been made of a series of cases of calcification involving the aortic and mitral rings and the leaflets. The aortic and mitral rings are demonstrable *in vivo*, with short exposures made possible by high voltage, high milliamperage, and a short distance between the anode and the patient. Aortic ring calcification is seen in the middle anterior third of the heart shadow. It is smaller than leaflet calcification and more regular. Calcifications in the mitral annulus fibrosus are probably of less clinical significance than in the aortic ring. Mitral ring calcifications usually begin in the central portion of the annulus, and this position, with their homogeneity and regularity are identifying characteristics. They are not infrequently incidental findings in elderly persons undergoing gastro-intestinal examination. Mitral leaflet calcifications occur in younger people and produce a snapping motion; they are triangular in outline and more localized. They are frequently associated with left auricular enlargement on a rheumatic basis.

Localization of calcifications of the annulus or leaflets is dependent on careful fluoroscopic as well as radiographic studies. The incidence of cardiac calcification would undoubtedly be higher if such studies were made a part of the routine examination.

Seven roentgenograms; 1 table.

MAURICE D. SACHS, M.D.
Cleveland, Ohio

Interatrial Septal Defect Associated with Syphilitic Aortic Insufficiency. Morris Lipson. Am. Heart J. **35:** 497–505, March 1948.

Two cases are recorded in which the autopsy diagnosis was syphilitic aortic insufficiency associated with a large interatrial septal defect. In each instance the clinical diagnosis had been syphilitic aortic insufficiency with congestive heart failure, based on cardiac enlargement, an aortic diastolic murmur, a Corrigan pulse with a wide pulse pressure, and a history of syphilis with positive serologic findings. This diagnosis, however, was somewhat untenable because of the occurrence of right axis deviation on all electrocardiographic tracings, in the presence of an apparent aortic regurgitation and an associated auricular fibrillation.

The combination of syphilitic aortic insufficiency with an interatrial septal defect is of rare occurrence. It should be suspected clinically when the former syndrome is associated with electrocardiographic evidence of right axis deviation and possibly auricular fibrillation, with roentgenographic findings of a distinctly dilated pulmonary artery.

One roentgenogram; 2 electrocardiograms; 2 photographs.

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THE DIGESTIVE SYSTEM

Differential Diagnosis of Abdominal Tumors by the Roentgen Method. Samuel Brown. New York State J. Med. **48:** 609–611, March 15, 1948.

The abdomen contains a number of organs and structures, occupying definite places, which bear a constant relationship to each other and leave no empty space in the cavity. Thus, according to the unalterable law that two bodies cannot occupy the same place, the enlargement of an organ or the presence of a new mass within the abdominal cavity will bring about displacement or compression, or both, of an adjoining structure.

In order to obtain a true idea of the exact position, shape, and size of any abdominal organ and its relationship to other organs, the abdomen must be subjected to a three-dimensional study. Thus, lateral projection of the abdomen is absolutely essential in the study of extra-gastroenteric tumors.

A brief but excellent review of the anatomical relations of the various abdominal organs in the various standard positions is presented. Application of the three-dimensional study permits the following deductions:

1. Displacement of the stomach and duodenum to the left and backward indicates a large liver; to the left and forward, a large kidney; only to the left, a large gallbladder.

2. Displacement of the stomach and duodenum to the right and forward is due either to a large spleen, kidney, or pancreas. Displacement backwards indicates enlargement of the left lobe of the liver.

3. Displacement or lack of displacement of the stomach and duodenum in opposite directions in the ventral position, but with forward displacement in the lateral position, indicates a retroperitoneal tumor, either pancreatic or glandular. Backward displacement indicates a liver tumor.

4. Enlargement and compression of the duodenal loop, both in the frontal and lateral projections, indicate a tumor of the head of the pancreas. Enlargement of the loop in the frontal position, but with narrowing in the lateral position, may be due to a superimposed tumor from the transverse colon.

5. Pressure defects upon the contour of the duodenum indicate a large gallbladder when the bulb is compressed. Pressure defect upon the superior angle indicates dilatation of the extrahepatic biliary ducts due either to stones or, more often, to tumors.

EDWARD E. LEVINE, M.D.
Dearborn, Mich.

Roentgen Manifestations of Intra-Abdominal Abscess. Samuel Richman. Virginia M. Monthly **75:** 124–128, March 1948.

The author discusses the difficulty of arriving at a diagnosis of intra-abdominal abscess (except subdiaphragmatic abscess), the necessity of prompt surgical intervention, and the value of roentgen examination, especially if gas is present in the abscess. The demonstration of an area of decreased density with fluid levels on an upright or lateral decubitus film is strongly suggestive of abscess. Such a shadow may occur in an area where normal gas-containing structures are not usually seen; the outline is patternless, and the position fixed.

Clusters of bubble-like shadows may be the first indication of an intra-abdominal abscess. Usually these are due to small air-containing vesicles which are separated from one another by fine peritoneal adhesions but they eventually coalesce to form a large single pocket.

In the absence of gas in the abscess, there is an area of increased density which appears to displace neighboring structures. In this event, x-ray evidence must be supplemented by clinical data to exclude a neoplasm.

The roentgen examination should include films in the supine, prone, and upright positions, as well as posterior-anterior views with the patient lying on either side.

Ten roentgenograms.

CHALMERS S. POOL, M.D.
University of Arkansas

Radiological Changes in the Gastro-Intestinal Tract of a Patient Following the Smithwick Operation. José M. Torre and Ramón Villarreal. Gastroenterology **10:** 543–544, March 1948.

A man of thirty-five who had undergone a Smithwick operation for hypertension complained of a change of bowel habits. Radiologic studies showed increased gastric peristalsis. At six hours, there was still some barium in the stomach, the small bowel was empty, and the colon was filled to the rectum. This change in motility in the gastro-intestinal tract is explained on the basis of vagotonism due to section of the sympathetic nerves.

JOSEPH T. DANZER, M.D.
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Malignant Disease of the Stomach Simulating Gastric Diverticulum. Charles D. Armstrong and Dwight L. Wilbur. M. Clin. North America **32:** 336–354, March 1948.

Diverticulum of the stomach is a rare condition characterized by vague and non-specific symptoms and by reasonably well defined roentgen signs which are, however, often misinterpreted or overlooked. The vital point is often the differentiation from a penetrating ulcer, and particularly from ulcerating neoplasm, which may simulate or accompany an uncomplicated diverticulum.

The following essentials for the x-ray diagnosis of

gastric diverticulum have been assembled from several sources:

1. The sac must be mobile and unattached to gastric tissues.
2. The shadow must be well defined, smooth, regular, and demonstrable at various angles.
3. Generally, there should be no tenderness over the area of filling. Tenderness may signify diverticulitis.
4. There should be present a niche-like opaque spot surrounded by a defect in the contrast shadow resembling an ulceration with surrounding infiltration, best seen in the vertical position and on expiration. (A diverticulum is larger on expiration, and when the patient is in the left oblique position and inspires deeply it diminishes in size, possibly because of the increased intra-abdominal pressure and the encroachment of other organs.)
5. The neck of the diverticulum should almost always be demonstrated and rugae noted in its mucosal lining. The stalk may be less readily found at operation or necropsy.
6. The sac should most commonly be at the cardiac end of the stomach, on the lesser curvature, toward the posterior wall.
7. There may be retention of barium at the site in the six- to forty-eight-hour films.
8. The mucosal pattern should be soft, well defined, and regular, showing no sign of irritation. Well defined rugae may lead right up to the diverticulum. Irregularity in the walls may mean a neoplasm.
9. The sac may occasionally be emptied by changing the position of the patient; this may indicate the most favorable position for therapeutic postural drainage.

The following conditions must be considered in the roentgenologic differential diagnosis: penetrating ulcer; malignant tumor; diaphragmatic hernia; diverticulum of the duodenum or jejunum overlying the stomach in the anteroposterior view. Carcinoma or sarcoma must particularly be suspected when x-ray examination shows atypical features, and when the history is short and the symptoms are severe. Special attention should be paid to the position of the "diverticulum" in the stomach. Benign "true" diverticula are infrequent elsewhere than on the posterior wall of the greater curvature within a few centimeters of the cardia; "false" or "acquired" diverticula, including those arising in gastric ulcer or neoplasm, occur typically in the lower two-thirds of the stomach. Repeated x-ray and gastroscopic examinations must be done in the event of an outpouching in this area, but their evidence is not always certain. In the final analysis, clinical judgment of the features presented by the individual case must be the deciding factor.

Two cases in which a malignant tumor simulated a gastric diverticulum are reported. In each instance repeated roentgen examinations led to confidence in the benign nature of the lesion and delayed recognition of the actual nature of the growth.

Four roentgenograms, 4 photomicrographs.

Roentgen Examination in Acute Dilatation of the Stomach. J. Frimann-Dahl. Acta radiol. **29:** 237–250, March 31, 1948.

This article consists of a number of case reports of gastric dilatation from various causes but all presenting an acute condition when seen. The diagnosis is made fairly easily in most cases from a flat film and, of course, is obvious at once upon ingestion of barium. Aspiration of gas and fluid after passage of a stomach tube confirms the diagnosis and in some cases provides all the treatment necessary.

Several of the cases are quite interesting because of the unusual roentgen findings.

Sixteen roentgenograms.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Transpyloric Herniation of Redundant Gastric Mucosa. K. K. Nygaard and Alexander Lewitan. Am. J. Surg. **75:** 502–515, March 1948.

The authors review the literature on the herniation of redundant gastric mucosa and report two cases of their own. There are no characteristic symptoms. The condition should be suspected in cases of bizarre dyspeptic complaints, high intestinal hemorrhages, and cases of gastritis.

The important roentgen findings are: (1) a scalloped filling defect in the base of the duodenal bulb, resembling a cauliflower, changing in size and character with peristalsis; (2) large gastric mucosal folds in the antrum that extend into the duodenum; (3) a persistently wide pylorus; (4) delayed emptying and retained secretions.

Conservative treatment gives indifferent results. Partial gastric resection is curative. Gastrotomy and plastic operations on the gastric mucosa have also produced good results.

Eight roentgenograms.

VERN W. RITTER, M.D.
University of Pennsylvania

Principle of Evacuation of the Stomach in Infants and Prematures. A Non-Radiologic Study. S. Vendel. Acta paediat. **35** (Supp. I): 178–185, March 1, 1948.

The author has attempted to follow the entire course of evacuation of the stomach in infants. Diverse opinions based on roentgen studies are cited, but such studies, the author claims, reveal only the initial and final points of evacuation. His method involves interval aspiration and measurement of an initially measured normal pediatric feeding through a small catheter. The results demonstrate an extreme regularity of emptying, dependent on the infant's age and the constituents of the meal. Gastric emptying, the author finds, is subject to less variation than is commonly thought.

Two charts.

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Roentgenologic Examination of the Small Intestine. C. Allen Good and M. Elizabeth H. Fletcher. J. M. A. Georgia **37:** 67–74, March 1948.

Examination of the small intestine is one of the most difficult tasks which confronts the roentgenologist. Usually three to eight periods of fluoroscopy are required to examine the entire small intestine after the barium meal. Because of this, and since the diseases which involve this segment of the digestive tract are relatively rare, the examination should be used only in carefully selected cases. It should not be undertaken until it is shown that there is no demonstrable lesion in the stomach, duodenum, or colon, which might account for the symptoms.

The lesions most frequently encountered in the small intestine during roentgenologic examination are non-

specific regional enteritis, benign or malignant neoplasms, and Meckel's diverticulum. *Regional enteritis* involves the terminal portion of the ileum most commonly, but may occur anywhere in the small bowel. The cecum is frequently affected. The common symptoms are diarrhea, cramping abdominal pain, and loss of weight. A correct roentgenologic diagnosis of *neoplasm* of the small intestine was made in 36 of 42 adequately examined cases (85.7 per cent). Tumors manifest themselves by obstruction, intussusception, or a filling defect in the barium column. Common symptoms include evidence of loss of blood, presence of an abdominal mass, and partial intestinal obstruction. *Meckel's diverticulum* is the lesion most likely to be overlooked by the roentgenologist. The usefulness of the roentgenologic examination in this condition lies in the exclusion of other lesions which might produce the symptoms of which the patient complains, rather than in visualization of the diverticulum. The common symptoms are hemorrhage, partial obstruction, pain similar to appendicitis, and intussusception.

The diagnostic accuracy of the roentgenologic examination of the small intestine is highest in cases of regional enteritis, fairly high in cases of tumor, and lowest in Meckel's diverticulum.

Five roentgenograms; 1 photomicrograph; 1 photograph.

EDWARD E. LEVINE, M.D.
Dearborn, Mich.

Roentgenologic Diagnosis of Tumors of the Small Intestine. J. C. Root. M. Clin. North America **32:** 436–442, March 1948.

Roentgen examination is the most valuable procedure by which a definite diagnosis of tumor of the small intestine can be made. The examiner has the choice of three technics, which may be used singly or in combination: (1) motility examination or interval study, in which barium is given orally; (2) the so-called "small intestinal enema," in which duodenal intubation is employed with the injection of a thin solution of barium through the tube; (3) the standard barium enema study in which success depends upon reflux of a sufficient amount of the solution through the ileocecal valve for visualization of the terminal ileum.

The oral administration of the barium solution will allow visualization of the entire length of the small intestine and is more satisfactory for lesions located in the proximal or midportions of the bowel. The barium enema is, as a rule, more useful for demonstration of a lesion in the terminal portion. Duodenal intubation has been used only occasionally by the authors, as they have found it somewhat difficult to obtain adequate visualization of the entire small intestine by this means. This is due in part to the length of bowel which is filled with the solution at one time, resulting in considerable overlapping of the intestinal loops.

The usual procedure when a lesion of the small intestine is suspected is to employ first the interval study, the interval viewing depending upon the time required for the passage of the opaque solution through the intestine. More frequent films or fluoroscopic examinations are made if any suspicious change is observed. In all cases, a small amount of barium mixture, generally not more than 2 ounces, is used; this permits adequate visualization without the overlapping loop shadows which occur if a larger amount is given. The patient drinks the barium mixture in small sips during the initial fluoroscopic examination so that the proper amount may be determined. Spot films are taken immediately if any abnormal changes are seen.

The criteria for diagnosis of tumors of the small intestine are much the same as for other portions of the gastro-intestinal tract, the most important being a localized deformity of the column of barium, which may manifest itself as a filling defect, an annular constriction, or an infiltrative defect in the wall of the bowel, or possibly by a combination of these. Other changes associated with tumor are alteration or obliteration of the mucosal pattern at the site of the lesion, obstruction, and ulceration.

Seven roentgenograms.

Intussusception in Children. Diagnosis and Therapy with Barium Enema. Hans Hellmer. Acta radiol., Suppl. 65, 1948. 120 pp.

The two main purposes of the author are to describe the roentgen picture of intussusception in children and to discuss the possibilities of its reduction during continuous roentgenologic control. The study covers 169 cases, of which 162 were successfully diagnosed by barium enema study.

The intussusceptions are divided according to their point of origin into (1) those starting in the small intestine and (2) those starting in the large bowel. Of 100 cases thus classified, 91 fell in the first group and 9 in the second. In 61 cases the exact starting point could not be determined.

In his chapter on roentgen diagnosis, the author first discusses the value of the plain roentgenogram, which may reveal not only evidence of ileus but may also aid in localization of the intussusception. By use of the barium enema the characteristic defect is demonstrated, but it is considered doubtful that the appearance of the defect alone can differentiate between intussusception starting in the large bowel and that starting in the small intestine. Descriptions are included of the changes observed in intussusceptions starting in the colon distal to Bauhin's valve, those starting in the cecum, and those starting in the small intestine.

When the diagnosis has been made by barium enema, attempts are immediately made to reduce the intussusception with the aid of pressure of the enema fluid. The criterion of success is that the contrast fluid fills out the entire large bowel, including the cecum, and then passes through the ileocecal valve and high up in the small intestine. Reduction with barium enema was successful in 130 out of 162 cases. No deaths occurred among these cases. The author warns the individual physician, however, against using this method therapeutically without a trained staff and without a personal knowledge of the mechanism, clinical picture, and roentgenology of intussusception.

Fifty illustrations (35 roentgenograms); 6 tables.

Roentgenologic Diagnosis of Tumors of the Large Intestine. C. Robert Hughes and Emmett J. O'Malley. M. Clin. North America **32:** 428–435, March 1948.

This article on the roentgenologic diagnosis of tumors of the large intestine would probably be of more interest to others than to the experienced radiologist, but it furnishes a good review of the subject. The routine procedure for the use of the barium enema at the Cleveland Clinic is described. Spot films are always taken to show the sigmoid loop and the ileocecal region; this

practice has proved of particular value in demonstrating early lesions that were not suspected during fluoroscopy. The roentgen features of annular and polypoid carcinoma are described, and the differentiation of carcinoma from other lesions is discussed.

Eight roentgenograms.

Diagnosis and Treatment of Acute Malignant Obstruction of the Large Bowel. Marshall L. Michel. New Orleans M. & S. J. **100:** 397–408, March 1948.

Michel reviews 55 cases of obstructing carcinoma of the large bowel treated by 25 different surgeons, with a mortality rate of 33 per cent; 52 of the 55 cases were operated upon and 8 different types of operative procedure were employed. Lack of uniformity in treatment and the high mortality rate prompted this study. It is devoted to acute complete obstructions.

The age range in the series reviewed was from thirteen to eighty-six years. A rather long duration of malignant disease before acute obstruction supervened was considered to be a definite factor in the mortality rate. All the tumors were adenocarcinoma, and the majority were of the annular type. The location is given for 45 cases, of which 31 were in the left colon, with its smaller lumen and less distensible walls, while 14 were in the right colon. The chief signs and symptoms of acute obstruction were: (1) inability to defecate or expel flatus; (2) cramping abdominal pain; (3) vomiting (in 39 of 55 patients); (4) abdominal distention; (5) abdominal tenderness, frequently localized in the lower right quadrant because of a distended cecum; (6) an intra-abdominal mass; (7) low-grade fever. Six cases were incorrectly diagnosed as small bowel obstruction and in two of these, the obstruction was due to carcinoma of the cecum, rendering differentiation from other small bowel obstructions difficult by either clinical or roentgenological methods.

Roentgenologic studies of the abdomen usually showed marked distention of the colon up to the site of the tumor. Distention of the small intestine was also present in a large proportion of cases. The author calls attention to the importance of associated small bowel distention in order that the primary source of the occlusion may not be overlooked and non-surgical decompression substituted for early operation. He stresses the value of upright films and of barium enema studies. He feels that even when the plain film of the abdomen shows evidence of colonic obstruction, a barium enema study is necessary for exact localization of the growth in order that exploration at operation can be reduced to a minimum. He cautions against forcing the barium past the point of obstruction and against the use of the barium meal. He discusses the different methods of handling obstructions in the right and left colon. He prefers simple loop colostomy of the right transverse colon in obstructing tumors of the left colon and either cecostomy, ileostomy, or ileo-transverse colostomy in obstruction of the right colon.

ROBERT C. PENDERGRASS, M.D.
Americus, Ga.

Microcolon. With Report of Two Cases. Johannes Zimmer. Acta radiol. **29:** 228–236, March 31, 1948.

Two types of microcolon are found, primary and secondary. The primary type is due to disuse as a result of inspissated meconium in the small intestine blocking the passage of fecal content into the colon. The secondary type is also caused by disuse, but in this case there is an organic stenosis or atresia proximal to the sigmoid.

From the evidence contributed by a single case of each type, the author states flatly that fluid levels are absent in the primary type and present in the secondary; that coarse granular fecal matter can be seen in the distended loops in the primary type but not in the secondary.

Both types are, of course, serious surgical emergencies, presenting difficult technical problems in anastomosing the tiny loops and maintaining the fluid balance. The mortality is high.

A barium enema is not contraindicated and may be very helpful.

Seven roentgenograms; 1 photograph.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

A Pathognomonic Roentgen Sign of Retroperitoneal Abscess. Report of Two Cases of Ruptured Appendix with Positive Roentgen Findings. Gustavus C. Bird, Jr., George E. Fissel and Barton R. Young. Am. J. Roentgenol. **59:** 351–353, March 1948.

Two cases of appendicitis with rupture and retroperitoneal abscess formation caused by gas-forming organisms are reported, both showing multiple small gas shadows behind the colon. Undoubtedly the original films on these cases must be interesting, but the main feature (the small multiple gas bubbles) is lost completely in the small reproductions. It is unfortunate that enlarged studies of the area in question are not given. The description is enough, however, to put one on the alert for these shadows in films of acute abdominal emergencies. The authors state that their localization is facilitated by stereoscopic posterior or oblique projections.

Four roentgenograms. ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Displacement of the Cecum into the Left Iliac Fossa. The Diagnostic Insignificance of McBurney's Point. P. C. Smyrniotis. Radiol. clin. (Basel): **17:** 84–91, March 1948. (In French.)

The author believes that the diagnostic importance of McBurney's point has been overestimated. In a large series of cases (exact number not stated) he found only 50 per cent in which the position of the cecum could be thus determined. In the remainder it was displaced. Such displacement may be due to disturbances in the rotation of the alimentary tract in embryonic life, it may occur reflexly during fluoroscopic examination, or it may be due to over-filling of the cecum.

The usefulness of roentgen examination for determination of the position of the cecum and appendix is stressed and some illustrative cases are cited: A 20-year-old female was to be operated upon for a chronic appendicitis but insisted upon a roentgen examination before surgery. This revealed displacement of the cecum into the left lower quadrant of the abdomen and operation was avoided. Another patient had pain in the right upper quadrant. A roentgen examination of the gastro-intestinal tract revealed a normal stomach and duodenum, but a displaced cecum with an appendix showing signs of chronic appendicitis. This diagnosis was confirmed by surgery.

Four roentgenograms; 5 diagrammatic drawings.

EUGENE F. LUTTERBECK, M.D.
Chicago, Ill.

Chronic Amebiasis of the Cecum. Raymond B. White. Illinois M. J. **93:** 102–106, February 1948.

White emphasizes that no pathognomonic sign or pattern is produced in the cecum by amebic infection, but predominance of cecal involvement, as compared to the remainder of the colon, makes it imperative that suggestive roentgen changes be noted as a basis for further clinical and bacteriological study. The more common changes in chronic amebiasis of the cecum are (1) loss of pliability of the cecal wall; (2) narrowing and irregularity of the lumen; (3) shortening of the cecum; (4) absence of a sharp line of demarcation between the cecal involvement and contiguous ascending colon; (5) absence of abnormal structural change in the adjacent ileum. Patency of the ileocecal valve, without the usual normal delay in filling of the terminal ileum until the cecum is distended is another very suggestive sign. The cecal changes in chronic amebiasis persist for a long period and are probably irreversible. An analogy is drawn between the scarring in the duodenal bulb after an ulcer heals and the deformity persisting in the cecum after adequate treatment of amebiasis.

Six roentgenograms.

ROBERT C. PENDERGRASS, M.D.
Americus, Ga.

Amebiasis and Indeterminate Ulcerative Colitis. Combined Therapy as Applied to Veterans from Overseas. E. N. Collins and F. L. Bynum. M. Clin. North America **32:** 408–418, March 1948.

During and since World War II an increased number of patients with the usual findings of indeterminate or chronic non-specific ulcerative colitis have made a dramatic initial response to anti-amebic therapy, even though evidence of amebiasis has not been found on repeated examination. Following this therapy, sulfonamides and other forms of treatment for indeterminate ulcerative colitis have been used. In these cases it is thought that the initial infection may have been due to amebiasis but that other invading organisms have changed the clinical picture by the time of examination.

In the authors' experience the roentgen picture is normal in almost all patients who harbor *Endamoeba histolytica*. The examination, therefore, is important because of its negative value. In rare instances where positive roentgen evidence of amebic colitis is present, the findings are those of other chronic ulcerative diseases pertaining to the cecum and ascending colon. There is shortening of the ascending colon, with alterations in the mucosal pattern characteristic of ulcerative disease. Part of the survey in a patient presenting bloody diarrhea includes a roentgenogram of the chest. In adults tuberculous enterocolitis is rarely seen unless there is an open process in the lung.

One hundred consecutive cases seen at the Cleveland Clinic since World War II, in which *Endamoeba histolytica* was isolated, were reviewed. Only 11 of the 100 patients had acute dysenteric symptoms at the time of the original examinations. No patient in this group presented the typical amebic ulcers surrounded by normal mucosa which are characteristic of amebic colitis, and in only 3 cases was there roentgen evidence of amebic colitis by barium enema examination, that is, evidence of ulceration of the cecum with shortening of the longitudinal axis of the right colon, where *Endamoeba histolytica* colonizes. Four of the 11 patients who had acute dysenteric symptoms gave proctoscopic and roentgen evidence of indeterminate ulcerative colitis. In 1 case the disease was limited to the rectum and sigmoid; in the other 3 cases the rectum, entire colon, and terminal ileum were involved. All 4 patients made an excellent response to the combined therapy mentioned above.

Each patient presents an individual problem. The variable severity of the disease and the fact that it is characterized by spontaneous remission of symptoms make the correct evaluation of any one factor in treatment impossible. Usually no single form of therapy is employed.

Three roentgenograms.

Amebiasis in Veterans of World War II with Special Emphasis on Extra-Intestinal Complications, Including a Case of Amebic Cerebellar Abscess. M. A. Spellberg and Simon Zivin. Gastroenterology **10:** 452–472 March 1948.

It has been predicted that there will be an increased incidence of amebiasis in this country because of the return of American troops from areas where the native population was highly infected. This trend has proved true at Hines Veterans Hospital, where the admissions for this condition in 1946 were five times greater than before the war. In 1946, 58 patients were admitted with amebiasis, 43 of whom had amebic colitis, 8 amebic abscesses of the liver, and 7 amebic hepatitis.

The hepatic complications of amebiasis are easily confused with other conditions, and appropriate treatment may be delayed, with serious results. The most common symptom is a dull abdominal pain, usually, but not always, localized in the right upper quadrant. This is accompanied by hepatic tenderness and the liver is invariably enlarged. In all the authors' cases elevation of the right diaphragm was demonstrable roentgenologically. Four patients showed roentgen evidence of lung involvement. All but one patient had an erratic fever and the leukocyte count was moderately elevated.

In the cases where hepatic abscess was diagnosed, a needle was inserted between the 9th and 10th ribs and a chocolate-colored pus was drawn off in varying amounts. Following this procedure, the elevated diaphragm was generally reduced and the size of the liver began to approach normal. The treatment of choice for amebic hepatitis is emetine, which should be started as soon as possible.

Five cases are reported in some detail. In one of these (hepatic abscess) there was a further complication in the form of a cerebellar abscess.

Six roentgenograms; 7 charts; 1 table.

JOSEPH T. DANZER, M.D.
Oil City, Penna.

Actinomycosis of the Liver with Recovery. L. M. Shorvon. Lancet **1:** 439–441, March 20, 1948.

A boy, aged nine, with a two months history of abdominal pain following appendectomy, was found at laparotomy to have actinomycosis of the liver. Within six months an abscess developed in the abdominal wall, with discharging sinuses. The child received local and systemic treatment with penicillin, but on admission a year after laparotomy his condition was grave, with fever, anemia, abdominal distention, and dyspnea. Under intensive treatment, chiefly with x-rays (first course deep x-ray therapy, 950 r to the liver; second course, four months later, 800 r), penicillin, sulfathiazole, and potassium, supplemented by blood transfusion

and vaccine therapy, recovery took place within the next nine months.

The author believes radiotherapy valuable in the treatment of actinomycosis. Though radium or deep x-rays can both be used, x-rays are to be preferred for practical reasons. Smaller doses are given in abdominal actinomycosis than are customarily used in the cervicofacial type, and the field is limited as far as possible to the site of the lesion. If infection becomes acute, the doses are reduced or the treatment is interrupted.

Carcinoma of the Pancreas. Diagnostic Criteria. Grayson F. Dashiell and Walter Lincoln Palmer. Arch. Int. Med. **81:** 173–183, February 1948.

Ninety cases of carcinoma of the pancreas are reviewed and compared with those in other series in the hope that earlier recognition of the disease may be accomplished. In 83 of the cases the diagnosis was confirmed by operation and usually corroborated by biopsy, and in some instances it was also confirmed at autopsy. In 5 patients not subjected to operation the diagnosis was confirmed at autopsy.

The average age of the patients on their admission to the hospital was 55.9 years; this is identical with the average age reported by twelve previous authors. The sex ratio was 2 men to 1 woman; in a large group reported by 21 authors this ratio was 10 to 4. As the chief complaint pain predominated (75 patients), followed in frequency by jaundice (60 patients), loss of weight (72 patients), anorexia (72 patients), constipation (36 patients), nausea and vomiting (24 patients). The gallbladder was palpated preoperatively in 52 per cent of the jaundiced patients. An epigastric mass was noted in 32.2 per cent of the patients. A preoperative glycosuria, although often transitory, was found in 21 of the 81 cases studied.

Notwithstanding the lack of a radiopaque dye which can be selectively absorbed by the pancreas, the indirect evidence afforded by careful roentgen examination greatly enhances the chance of correct diagnosis. In this series evidence suggestive of the lesion was present in 35 (48.6 per cent) of 72 patients examined. The signs found most commonly were irregularities of the duodenal contour in 13 cases (18 per cent), distortion and displacement of the stomach in 10 cases (14 per cent), deformities of the duodenal bulb, sometimes with crater, in 9 cases (12.5 per cent) and expansion of the duodenal loop in 4 cases (5.6 per cent). Diverticulum of the second portion, observed in 4 patients, was not included among positive findings. On the basis of operative findings, lesions of the body and tail were found to be less likely to produce roentgen signs than those of the head, but they frequently distort the posterior wall of the body of the stomach or depress the stomach along the lesser curvature.

Cholecystograms disclosed non-visualization of the gallbladder in 19 patients with jaundice and in 6 of 8 patients without jaundice. In only 2 instances was there a fully normal visualization; in 7 the roentgenograms disclosed stones.

Eight roentgenograms; 1 chart; 5 tables.

Pancreatic Calcification: Study of Clinical and Roentgenological Data on Thirty-Nine Cases. Earl E. Gambill and David G. Pugh. Arch. Int. Med. **81:** 301–315, March 1948.

A study was made by the authors, of the 39 patients seen at the Mayo Clinic in the years 1939 to 1943 inclusive, in whom the criteria for the roentgenologic diagnosis of pancreatic calcification were fulfilled. The objectives of the analysis were (1) to study the symptomatology and the roentgenologic features and (2) to learn whether there is any correlation between the extent of calcification in the pancreas and the incidence of clinical manifestations, with particular reference to the manifestations of other complications of pancreatic disease, such as diabetes mellitus and steatorrhea.

A study of the records revealed that calcareous deposits in the pancreas were usually but not always associated with relapsing pancreatitis. Commonly the symptomatology was that of pancreatitis, although in approximately two-fifths of the cases there was either no history of pancreatitis or a doubtful one. Among cases in which a definite history of pancreatitis was obtained, calcification became evident in a fifth in one year after the onset of pain, but in another fifth calcification was not discovered until after eleven to twenty-two years. Associated complications in the order of frequency of occurrence were diabetes, steatorrhea, gastro-intestinal hemorrhage, morphinism, pancreatic pseudocyst, pancreatic abscess and peripheral neuritis. There was a high degree of positive correlation between the extent of pancreatic calcification and the incidence of diabetes and steatorrhea. Diabetes and steatorrhea occurred only in cases of calcification in which there was a definite diagnosis of pancreatitis.

Calcareous deposits in the pancreas are almost always rather dense and therefore radiopaque. For this reason, the roentgenologic diagnosis can be made with accuracy. Any roentgenograms that include all or part of the pancreatic region may reveal calcareous deposits. In this series the deposits were seen most frequently, perhaps, in cholecystograms or in localized films of the gallbladder region. They were also discovered during x-ray examination of the gastro-intestinal tract. In some instances roentgenograms of the abdomen or of the urinary tract revealed their presence. In films of the lumbar vertebrae they were seen not only in the anteroposterior projection but also in the lateral and oblique views. If pancreatic calcification is suspected, localized anteroposterior, oblique, and lateral roentgenograms of the area centered around the first and second lumbar vertebrae are most helpful. The location of the pancreas varies somewhat depending on the patient's habitus, but in this series calcareous shadows were seen most frequently at the level of the first and second lumbar vertebrae. At times they were seen as high as the level of the eleventh thoracic vertebra or as low as the level of the third lumbar vertebra. Calcification was present in various sites in the pancreas, but it was seen most frequently in the head, just to the right of the spinal column. At times calcification was situated in the head or body of the pancreas overlying the vertebrae, thus making the calcific shadows difficult to see. Oblique and lateral films were of assistance in such instances. It is important that the roentgenograms cover the entire pancreatic region, since otherwise small localized shadows of calcification, particularly if situated in the tail of the pancreas, may be missed.

Other conditions which produce calcific shadows in the upper part of the abdomen must be differentiated from pancreatic calcification. Gallstones are frequently facetted, are more laterally situated, and are not often so densely calcified as are calcific deposits in the pancreas. Stones in the common bile duct are seldom

densely calcified. Renal calculi are seen somewhat lateral to the pancreatic region. Calcified mesenteric nodes in the region of the head of the pancreas may be difficult to distinguish from calcification within the pancreas, but as a rule the so-called mulberry appearance of calcified nodes and their presence in other parts of the abdomen make possible the correct diagnosis. Calcification of the suprarenal gland can usually be identified by its location and shape. Calcification of the abdominal aorta is linear and can be easily distinguished in the lateral view. Calcification of the arteries of the celiac axis produces linear, crescentic or annular shadows. Special roentgen studies, such as filling the stomach and duodenum with barium to show the relation of shadows to the pancreatic region, are seldom necessary.

For patients who are afflicted with frequent attacks of severe pain, surgical intervention is the treatment of choice, although it is not always effective in stopping the pain and the results in a given case are unpredictable. Surgical procedures were carried out in 18 of the 39 cases in the present series, for various reasons. In a few cases spontaneous amelioration of the painful seizures occurred; in others the disease progressed in spite of all efforts by the clinician and the surgeon.

Nine roentgenograms; 4 tables.

Diaphragmatic (Esophageal Hiatus) Hernia. Leonard K. Stalker and Morris J. Moskowitz. New York State J. Med. **48:** 641–642, March 15, 1948.

A woman of sixty-six gave a history of recurring attacks of indigestion for over forty years, attributed at various times to gallbladder disease, peptic ulcer, and gastric carcinoma. A roentgenogram of the chest showed a large gas bubble behind the heart. This suggested the possibility of a diaphragmatic hernia, and on barium study at least two-thirds of the stomach was found to be above the diaphragm. The hernia was successfully repaired and symptoms disappeared.

Two roentgenograms.

Right Paraduodenal Hernia with Roentgen Diagnosis and Postoperative Recovery. Robert J. Reeves, Frank T. Moran, and Paul A. Jones. Am. J. Roentgenol. **59:** 338–342, March 1948.

The authors reviewed the reported cases of right paraduodenal hernia and found that only 2 of a total of 51 were diagnosed correctly before operation (Taylor: Brit. J. Surg. **17:** 639, 1930; Exner: Am. J. Roentgenol. **29:** 585, 1933. Abst. in Radiology **22:** 642, 1934). A third is added, showing the typical spherical sac-enclosed appearance of the loops of small bowel and the displacement of the colon around the sac. The constriction of the duodenum at the neck of the sac is also shown. A film made after surgical correction shows the intestines in their normal relationship to each other.

Three roentgenograms; 1 drawing; 1 table.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

THE SPLEEN

Cyst of the Spleen. Case Report. V. F. Lang, S. A. Morton, J. D. Steele, and A. A. Schaefer. Ann. Surg. **127:** 572–576, March 1948.

Primary cysts of the spleen, as distinguished from those occurring as a result of degenerative processes due to disease or trauma, are apparently rare. A case is reported in which the presenting symptoms and signs were of thoracic origin. On initial observation, the patient, a 39-year-old woman pregnant for the first time, complained of pain in her chest. X-ray examination revealed considerable density at the left base, and evidence of effusion subsequently appeared. The finding of cholesterol crystals in fluid removed on thoracentesis suggested a possible cystic origin. Spontaneous abortion occurred, and as the patient's symptoms improved, more adequate roentgen study was possible. In addition to the effusion in the posterolateral aspect of the left chest, a spherical, calcified lesion was seen in the region of the left side of the diaphragm. Later, the stomach was outlined with barium and a gas-producing substance was given by mouth to determine the relation of the stomach to the calcified lesion. A diagnostic pneumoperitoneum was also induced. The preoperative roentgen diagnosis was a cystic mass with a calcified wall in the abdomen on the left side just below the diaphragm. The contents of the cyst were believed to have erupted through the diaphrgam and to have secondarily involved the pleural cavity.

At operation the cyst was found to arise from the spleen, and splenectomy was performed. The pathologic diagnosis was an epidermoid inclusion in the spleen with cyst formation.

Four roentgenograms; 1 photograph.

THE MUSCULOSKELETAL SYSTEM

Lengths of the Femur and Tibia: Norms Derived from Orthoroentgenograms of Children from Five Years of Age Until Epiphysial Closure. Margaret Anderson and William T. Green. Am. J. Dis. Child. **75:** 279–290, March 1948.

Using two large groups of children followed by serial films from the age of five to thirteen, the authors constructed curves showing the normal growth of the femur and tibia in boys and girls until epiphyseal closure. Skeletal age rather than chronologic age was used, giving curves of constant shape, and therefore more accurate. Todd's method of determining skeletal age was used (Atlas of Skeletal Maturation: Hand. St. Louis, C. V. Mosby Co., 1937). The filming technic was that of Green, Wyatt, and Anderson (J. Bone & Joint Surg. **28:** 60, 1946. Abst. in Radiology **47:** 542, 1947), which gives very accurate readings rather simply. A single film is used with three separate exposures, one over the hip, knee, and ankle. This allows the central ray to pass through the ends of both bones so that there is no magnification. Six feet is the distance used.

The curves, which are reproduced, will be of great value to anyone with a problem concerning any phase of bone growth in the lower extremity.

One roentgenogram; 5 graphs; 4 tables.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Development of Rickets in Premature Infants. Gert v. Sydow. Acta paediat. **35:** (Supp. I): 169–176, March 1, 1948.

It has been shown by several investigators that the low content of bone-building minerals in human milk will cause rachitic changes in premature infants given this food exclusively. Mineralization of the skeleton occurs mainly during the last intra-uterine months. Premature infants are therefore born with a considerably less mineralized skeleton than full-term infants.

Metabolism trials on infants show that the mineral retention which can be attained by feeding human milk exclusively is not sufficient to maintain the mineral content per kilogram of body weight at birth. Therefore, according to the author, rickets almost invariably develops in premature infants fed exclusively on human milk. A series of premature infants was examined at fourteen-day intervals, both radiographically and by blood chemistry studies. A control series of normal full-term breast-fed infants was also studied. In the first days of life the serum phosphorus in the premature was the same as in the full-term infant, but the serum phosphatase was about 1 1/2 times higher, and the serum calcium was 1 milligram per cent lower. The administration of vitamin D improved the serum calcium. Radiographically, bone changes interpreted as rachitic could occasionally be found as early as the fourteenth day. After the age of one month they were present in more than half of all examinations. The addition of either vitamin D or cow's milk to the diet did not with certainty prevent the development of the roentgen signs of rickets.

An attempt was made to correlate the roentgen signs with the blood chemistry in these cases. The serum phosphatase of infants given human milk was much higher in the cases which showed signs of rickets than in the cases with normal roentgen films. In the cow's milk series the difference was much less. Even those infants with x-ray evidence of rickets showed fairly normal values. The serum inorganic phosphorus values were also more normal in infants receiving human milk where no x-ray changes had appeared. No films are reproduced.

Two charts.

STANLEY H. MACHT, M.D.
Baltimore (Md.) City Hospital

Incidence of Bone Tumors in a Large General Hospital. L. P. Holmes, David Robinson, and Stephen W. Brown. J. M. A. Georgia **37:** 74–80, March 1948.

The principal object of this study is to recall the rarity of primary tumors of bone and the relative frequency of metastatic tumors as seen in a general hospital. In 16,363 roentgen examinations of bones made over a five-year period 106 bone tumors were diagnosed (0.63 per cent). These are classified in four groups: (1) primary benign tumors (33 per cent), (2) primary malignant tumors (9 per cent), (3) metastatic tumors to bone (49 per cent), and (4) soft-tissue tumors involving bone by direct extension (7.5 per cent).

The major roentgenographic differences between benign and malignant tumors are briefly discussed. The most characteristic roentgenographic finding in benign lesions is retention of continuity of bone. Even in lesions which expand into soft tissue, the soft tissue is pushed aside rather than invaded. In malignant lesions, there is dissolution of the contour shadow of bone. If soft tissues are invaded, this indicates that the neoplasm is probably malignant.

Films must be of excellent quality, showing both soft-tissue and bone detail.

Eleven roentgenograms; 5 tables.

EDWARD E. LEVINE, M.D.
Dearborn, Mich.

Osteoid-Osteoma. Raphael R. Goldenberg. J. M. Soc. New Jersey **45:** 104–107, March 1948.

Four cases of osteoid-osteoma are presented to reemphasize the clinical, roentgenographic, and microscopic characteristics of this tumor. A history of trauma was elicited in 3 of the cases; in one, symptoms persisted for ten years. The 3 patients treated surgically obtained complete relief from pain.

Four roentgenograms; 1 photomicrograph.

Angiosarcoma of the Petrous Portion of the Temporal Bone. Report of a Case. Joseph M. Kinkade. Ann. Otol., Rhin., & Laryng. **57:** 235–240, March 1948.

The author reports a case eventually diagnosed histologically as "angiosarcoma of the petrous portion of the temporal bone, possibly allied to the angiomatous group of meningiomas." The patient, a boy of eight years, was first treated for an inflammatory process. Subsequently a cystic swelling appeared behind the right ear. This was incised, yielding a blood-tinged serous fluid, but no significant regression occurred.

X-ray examination showed a large oval defect, measuring 3.5 cm. in diameter, in the posterior portion of the mastoid bone and partly involving the occipital bone. At its peripheral margins, bone reaction and decalcification were clearly evident. The mastoid area itself appeared densely sclerotic. Biopsy led to a diagnosis of a malignant growth—probably sarcoma.

Roentgen therapy was immediately instituted, 3,065 r being administered to the site of the lesion in twenty-one treatments over a thirty day period (150 r in air per treatment; 200 kv.; 10 ma.; filter equivalent to 1.65 mm. Cu; skin-target distance 50 cm.). The diameter of the field was initially 10 cm., but later smaller fields were employed. The secondary infection responded favorably and after the seventeenth treatment the tumor was reduced to one-third of its original size. Before termination of x-ray therapy, part of the remaining mass was removed by electrosurgery.

Two months after completion of the treatment, the patient complained of severe right-sided headache and intermittent vomiting. Neurological examination disclosed complete paralysis of all muscles supplied peripherally by the right facial nerve, and impairment of the sense of taste in the anterior two-thirds of the right side of the tongue. Hearing on the right side was markedly impaired. All other cranial nerves were functioning normally. X-ray films revealed a sharpening of the margins of the large oval bone defect but no further involvement of the bone by the neoplasm.

As radical mastoidectomy seemed inadvisable and the prognosis was unfavorable, a new course of palliative radiation was decided upon, but before it could be started, discharge from the ear occurred, bilateral exophthalmos developed, and death ensued, some ten months after the patient was first seen.

Autopsy demonstrated a tumor some 8 × 5 cm. on the right side of the skull. Springing from the bone in the posterior fossa of the skull close to the temporal bone, it evidently had pushed upward and formed a smooth cavity for itself within the brain. Through the floor of the skull in the mastoid region appeared an irregular opening, 2.5 × 1.5 cm., hemorrhagic in character, with smooth margins, and some bone spicules. It could not be determined whether the tumor arose from some portion of the arachnoid within the petrous bone (perhaps the porus acusticus internus) or from some structure native to the bone itself. The histopathological diagnosis, as stated above, was angiosarcoma.

Two photographs; 1 photomicrograph.

STEPHEN N. TAGER, M.D.
Urbana, Ill.

Pseudotumor of Bone in Hereditary Pseudohemophilia. Howard S. J. Walker and Nathan A. Womack. Arch. Surg. **56:** 329–337, March 1948.

A man aged 33 had a familial hemorrhagic diathesis which careful laboratory study showed not to be a true hemophilia. He gave a history of a tumor of the thigh at sixteen, following an injury. Three years later a pathologic fracture occurred at the site, with delayed union. Subsequently there was gradual shortening of the leg with formation of a pseudarthrosis. Radiographic examination showed changes in the femur resembling a giant-cell tumor. Because of the patient's bleeding tendency, x-ray therapy was given, but without improvement. Several months later an acute episode with marked cylindrical swelling of the thigh and extreme pain led to amputation. The specimen showed complete absorption of the lower femur, with extensive clot formation and necrosis and absorption of the muscles. The condition was believed to be secondary to intramedullary hemorrhages resulting from the hemorrhagic diathesis.

The authors could find no report in the literature of similar bone manifestations in association with pseudohemophilia, though several cases of pseudo-tumor in hemophiliacs are cited.

One roentgenogram; 1 photograph; 3 photomicrographs; 1 genealogic chart. LEWIS G. JACOBS, M.D.
Oakland, Calif.

Multiple Cartilaginous Exostoses and Heredity. U. Pfändler. Schweiz. med. Wchnschr. **78:** 230–232, March 13, 1948. (In French.)

This paper is a report of a family in which 7 of 25 males in a 4 generations displayed multiple cartilaginous exostoses. The 14 females in the same generations were all free from this condition. Stocks and Barrington's compilation of 184 such families and 2 Swiss families subsequently reported by Roeder are mentioned. While the tumors are as a rule more or less asymptomatic, one of the patients in this series had a pelvic exostosis of such size as to lead to pressure symptoms of some severity.

Eleven roentgenograms; 3 photographs.
LEWIS G. JACOBS, M.D.
Oakland, Calif.

Diagnosis and Differential Diagnosis of Primary Bone Infarcts. H. R. Schinz and E. Uehlinger. Radiol. clin. (Basel) **17:** 57–65, March 1948. (In German.)

Since bone infarcts are relatively unknown in Europe, the authors call special attention to the studies made in America by Phemister and Kahlstrom. The well known pathological, clinical, and roentgen features are discussed.

The roentgen picture varies with the age of the lesion. New infarcts cannot be recognized. Later, areas of calcification are demonstrable and necrotic areas become demarcated. Sites of preference are the epiphyses and the metadiaphyseal areas of the long bones. A typical location is the distal end of the femoral shaft. If the infarcts are in close relationship to a joint, they may give rise to secondary changes appearing in the roentgenogram as osteochondritis dissecans or osteoarthrosis deformans.

The clinical picture is often insignificant. Only with the development of osteochondritis or secondary arthritis are symptoms to be expected.

The principal lesions to be considered in the differential diagnosis are calcifying enchondroma, osteoid osteoma, and Brodie's abscess. Epiphyseal infarcts must be distinguished from tuberculosis, osteochondritis dissecans and arthritis deformans.

Two illustrative cases are reported.

Eight roentgenograms; 2 drawings.
EUGENE F. LUTTERBECK, M.D.
Chicago, Ill.

Heberden's Nodes. VII. The Roentgenological and Clinical Appearance of Degenerative Joint Disease of the Fingers. Robert M. Stecher and Harry Hauser. Am. J. Roentgenol. **59:** 326–337, March 1948.

The roentgen and external appearance of Heberden's nodes are considered in detail in this article, one of a series on this condition. In 100 patients, 40 were found to have other joints significantly involved by degenerative joint disease.

The first x-ray sign is narrowing of the joint space, but this may be preceded by a soft-tissue swelling composed of myxomatous material. After the narrowing of the joint space, eburnation follows and then spur formation. The value of lateral views of the terminal interphalangeal joints in demonstrating spurs is stressed, since many times dorsal spurring can be seen only in this view. The joint spaces may become very irregular and cyst-like areas often appear near or at the joint surface. The authors state that they have seen these punched-out areas disappear in a relatively short time in follow-up studies.

Five cases are reported in detail, with accompanying roentgenograms, several of them with progress studies made years after the original.

Fourteen roentgenograms; 6 photographs.
ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Heredity of Epiphyseal Dystrophies of the Hip Joint (Osteochondritis Deformans Juvenilis, Calvé-Legg-Perthes Disease). Michel Jéquier and Hermann Fredenhagen. Radiol. clin. (Basel) **17:** 92–112, March 1948. (In French.)

The etiology of Perthes disease is still unknown. The commonly accepted causes are trauma, infection, rickets, endocrine and circulatory disturbances. Only a few observers believe that the condition represents a genetic or hereditary problem. To emphasize this latter aspect, the present contribution is furnished.

After discussion of the characteristic clinical and radiological aspects, the authors report the history of two families. The first family report covers seven generations and the case histories of 22 members are given. In 14 cases definite evidence of Perthes disease was obtained and in 34 cases this diagnosis was made on the basis of information obtained by other people. Among 147 members of this family, 54 showed evidence of a dystrophy of one or both hip joints, which speaks for a dominant hereditary etiology. No endocrine anomaly or disease of the nervous system was present in any of these cases.

For the second family, no detailed histories are given, but the authors refer to an earlier publication (Jéquier, Michail, and Streiff. Confinia neurol. **6:** 277, 1945). There were 5 cases of dystrophy of the hip joints in this family, which showed in another branch evidence of congenital hereditary spastic paraplegia and degenera-

tion of the retinal pigmented layer. The type of inheritance in this instance was recessive.

Fifteen roentgenograms; 1 genealogical chart.

EUGENE F. LUTTERBECK, M.D.
Chicago, Ill.

Roentgen Picture of Osteo-Arthritis in the Hip-Joint in Cases of Polyarthritis Rheumatica Chronica. Ivan Hermodsson. Acta radiol. **29:** 139–151, Feb. 28, 1948.

In minute detail the author analyzes the various forms of involvement of the hip joint in hypertrophic and atrophic arthritis, which he designates as osteo-arthrosis deformans and chronic arthritis, respectively. Both conditions cause destruction of cartilage, but atrophic arthritis is apt to cause more destruction, particularly in the direction of the axis of the femoral head.

In the atrophic form there is often osteoporosis, which is never seen in hypertrophic arthritis. Osteophytes are characteristic of hypertrophic arthritis and do not occur in uncomplicated atrophy. In hips with maldeveloped heads—the flattened type, usually with an associated coxa vara—marked cartilage destruction and spur formation are frequently seen. In such hips the author believes that the abnormal conditions of strain are of such predominant significance that one cannot distinguish between the hypertrophic and atrophic types of disease.

Twelve roentgenograms; 2 tables.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Osgood-Schlatter's Disease. E. S. R. Hughes. Surg., Gynec. & Obst. **86:** 323–331, March 1948.

This is a widely varying interpretation of the pathological changes which take place in the presence of Osgood-Schlatter's disease. For a full understanding of the condition a knowledge of the anatomy of the tibial tuberosity is essential.

The tibial tuberosity shows a smooth proximal and a rough distal part. A groove separates the proximal portion and the upper anterior surface. The ligamentum patellae is inserted into the groove and into the smooth part. Immediately proximal to the groove is the deep infrapatellar bursa. The line of demarcation between the smooth and rough portions indicates the site of fusion which has taken place between the apophysis and diaphysis. The tuberosity develops with one or more apophyseal centers at the age of 11 years, and their fusion with each other and the epiphyseal tongue takes place a few months later. The apophyso-epiphyseal line closes at about 15 years.

The feature common to all the x-ray films was either ossification within or enlargement of the ligamentum patellae. The ossification may be found at the site of insertion into the tuberosity, in the ligament at a higher level, or at both these sites. The abnormal bone at the ligamentous insertion may be in the form of a linear ridge, a plaque of bone, or mottled and irregular ossification. The ossification situated higher in the ligament may be linear or irregular and may be connected with the bone formation at the insertion by bridges of bone. The epiphysis is never involved and the apophysis rarely. In those cases in which a mottled irregular ossification is displayed at the site of insertion some osteoporosis of the underlying bone is also shown.

In some of the series studied, the disease persisted or recurred after intervals of one to nine years. The tibial tuberosity in all these cases was prominent. Radiologic examination showed an enlargement of the tuberosity at the site of insertion of the ligamentum patellae; frequently a separate ossicle was present within the ligament and there was a tendency to the formation of an irregular buttress of bone just above the tuberosity, posterior to the tendon.

The author considers Osgood-Schlatter's disease a tendinitis rather than an epiphysitis. The ossification is caused by partial tearing of the ligamentum from the bone. The insertion of the tendon into the smooth portion of the tuberosity is not as firm here as it is into the groove, and this may well be the cause of the involvement of the former and the sparing of the latter as seen in most of the early x-ray films. The ossification higher in the ligament may be due to an extension of this osteoblastic reaction or to metaplasia of fibroblasts. In either case it would appear that the initiating stimulus is injury to the ligament, direct or indirect. Children are affected at an age when osteoblastic activity of this area is at a maximum.

Thirty-seven roentgenograms; 1 photograph; 1 graph; 1 table.

WILLIAM R. ALLEN, M.D.
University of Pennsylvania

Interesting Notes on Bipartite Patellae. John J. Callahan. U. S. Nav. M. Bull. **48:** 229–233, March-April 1948.

A series of 6 cases of bipartite patella is reported, all of which were diagnosed as simple fracture. The author briefly reviews the literature and gives diagrammatic sketches of the different types of this anomaly. In the usual type the smaller fragment is in the upper outer quadrant. Other types are the doughnut type, types with transverse and vertical fissures, the emarginate type, in which actually there is no second or third fragment, and the multipartite type.

A history of moderate injury with slight functional disability is suggestive of bipartite patella rather than fracture. Postero-anterior roentgenograms show a uniform space between the fragments without the serration characteristic of fractures.

Five roentgenograms; 6 drawings.

S. F. THOMAS, M.D.
Palo Alto, Calif.

Fracture of the Greater Multangular Bone (Report of Two Cases). Randolph L. Anderson and Theodore Katz. West Virginia M. J. **44:** 55–57, March 1948.

Two cases of isolated fracture of the greater multangular bone are reported—one due to a blow on the hand, the other to a gunshot wound. The symptoms of the injury are swelling and pain on the radial side of the wrist at the base of the thumb. X-rays confirm the diagnosis. They may show a spicule broken off the greater multangular bone, or perhaps a transverse fracture near the middle of the bone, or in some instances a comminuted type of fracture. The prognosis ordinarily is good, with little disturbance of function except for possible limitation of apposition of the thumb.

Fractures of the Tibial Condyles Involving the Knee Joints. Edwin F. Cave. Surg., Gynec. & Obst. **86:** 289–294, March 1948.

Fractures involving the weight-bearing joints should be restored to normal anatomical relationships as accurately as possible, even if operation is necessary. At

the Massachusetts General Hospital a fracture of the tibia near the joint is evaluated individually and treated accordingly. Those with little or no displacement can often be successfully treated by manipulation, while many with gross displacement and separation of condyles require operation.

The "bumper" fracture is the most important type of fracture involving the tibial condyles. Such fractures are produced by a force which sharply adducts and flexes the knee, compresses the external semilunar cartilage, strains or tears the internal lateral ligament or the cruciate ligament, or both, and at the same time, depending upon the severity of the force, impacts the lateral femoral condyle against the lateral tibial condyle, producing a compression fracture of the latter, which may be severely comminuted.

A force to the inner aspect of the knee may cause a fracture of the medial condyle with injury to the internal semilunar cartilage and to the external lateral collateral ligament.

Bursting fractures occur from severe trauma and falls from a great height. Such severely comminuted fractures the author believes to be best treated by manipulation, compression, and traction.

Roentgenograms of both knees should be taken in the same relative position with anteroposterior, lateral, and oblique views. If the injured knee is held in a position of flexion, the normal knee should be x-rayed in the same position. Little knowledge is gained from the lateral views, while the anteroposterior and oblique views will reveal the diagnosis. Because of the soft-tissue swelling, more than the usual x-ray penetration should be used to demonstrate the fracture lines.

The operative procedure for depressed fractures is described and illustrated and the paper concludes with an analysis of 98 tibial fractures treated at the Massachusetts General Hospital: 69 were treated between 1930 and 1945, and 29 between 1923 and 1930. A comparison of the two groups shows an increasing tendency to treat displaced fractures of the tibial condyles by surgical means.

In the 2 cases in the early series treated operatively, excellent results were obtained. In the later series, 21 of the 22 patients operated upon were returned to their former economic status and 18 had acceptable results from an anatomical and functional standpoint.

Four roentgenograms; 2 drawings; 3 tables.

HORACE G. BUTLER, M.D.
University of Pennsylvania

Fractures of the Ankle: Analytic Historic Survey as the Basis of New Experimental, Roentgenologic and Clinical Investigations. N. Lauge. Arch. Surg. **56:** 259–317, March 1948.

This review covers exhaustively the history and development of knowledge of ankle fractures and dislocations. It should be read in the original, as an adequate abstract is impracticable. Roentgenography has not provided an exact and detailed diagnosis, and is discussed here only as it bears on the history of our knowledge of these fractures. The author places particular emphasis throughout on the important role of ligament tears in the causation, type of deformity, and treatment of ankle fractures, and on the presence, often unrecognized even on roentgen study, of small anterolateral fragments torn from the tibia. He quotes the classification of Ashhurst and Bromer (Arch. Surg. **4:** 51, 1922) though he takes exception to their omission of marginal fractures of the tibia and of syndesmotic ruptures.

Fractures by adduction (tibial flexion)
- 1st degree: fracture of the lateral malleolus—transverse—at or below the level of distal articular surface of tibia
- 2d degree: 1st degree plus fracture of medial malleolus
- 3d degree: 1st degree plus supramalleolar fracture of tibia

Fractures by abduction (fibular flexion)
- 1st degree: fracture of medial malleolus
- 2d degree: 1st degree plus fracture of fibula (transverse, just above or below distal articular surface of tibia)
- 3d degree: medial malleolus represented by distal end of tibia

Fractures by external rotation
- 1st degree: oblique fracture of distal end of fibula
- 2d degree: 1st degree plus fracture of medial malleolus or rupture of its ligaments
- 3d degree: 1st degree plus supramalleolar fracture of tibia

Isolated fracture of posterior lip of tibia
Comminution of distal articular surface of tibia
T or Y fractures in distal end of tibia
Fractures by direct violence

One roentgenogram; 7 drawings.

LEWIS G. JACOBS, M.D.
Oakland, Calif.

GYNECOLOGY AND OBSTETRICS

Protrusion of the Acetabula as Complication of Labor. Jens Petersen. Acta radiol. **29:** 205–214, March 31, 1948.

Following the case history of a 32-year-old primipara with a forty-five-hour labor in which at least some of the protraction was thought to be caused by the bilateral protrusion of the acetabula, the author discusses the etiology of this interesting condition.

Etiologically there are three groups: (1) those due to a definite destructive arthritis of known cause, often unilateral; (2) those in older individuals without known cause, of insidious onset and with extensive spurring and eburnation; (3) those in young women with onset at the age of puberty with no signs of destruction or osteoarthritis.

Group 1 needs no further discussion.

Group 2 seems to be a form of hypertrophic arthritis from all the evidence. The depth of the acetabulum, the angle of the femoral neck, and the curvature of the spine seem to determine in which cases of hypertrophic arthritis of the hip protrusion of the acetabula will develop.

In Group 3 the actual cause is not known, but it is thought that probably hormonal factors or possibly late rickets may play a part, as well as the architectural features which contribute to the etiology in the second group.

Three roentgenograms.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Skiodan Acacia in Hysterosalpingography. Max Mass. J. M. A. Georgia **37:** 84–85, March 1948.

The author considers hysterosalpingography within the province of the radiologist. He employs the procedure for demonstration of the internal genitalia rather than as a test of tubal patency, using a combination of skiodan (40 per cent solution) and acacia (20 per cent). Usually about 10 c.c. of the medium is instilled and films are obtained immediately before instillation, and at rapid intervals during the procedure. Of a series of 140 patients examined by this method, about 60 per cent experienced some discomfort, but for the most part this cleared up within an hour.

EDWARD E. LEVINE, M.D.
Dearborn, Mich.

Therapeutic Value of Repetitive Lipiodal Tubal Insufflations. Robert N. Rutherford. West. J. Surg. **56:** 145–154, March 1948.

A study over a five-year period was made of 417 women with primary or secondary sterility in whom monthly lipiodol tubal insufflations were done. The technic for lipiodol injection is described in detail. Two films are taken: one after 12 c.c. of the medium have been injected and the pressure maintained for five additional minutes; the other, ten minutes after all apparatus is removed, to determine if dye is present in the pelvis.

Uterotubograms were obtained once monthly until tubal patency was established or until three consecutive attempts failed to demonstrate continued progress in opening the tubes. After patency was established, the procedure was repeated every three months, until pregnancy ensued. Of the group of 417 patients, tubal patency was re-established in 71 per cent and pregnancy occurred in 63 per cent. One patient died (mortality 0.25 per cent), and in 11 instances (2.6 per cent), there was a flare-up of an old pelvic infection.

Fifteen roentgenograms; 1 table.

MAURICE D. SACHS, M.D.
Cleveland, Ohio

THE GENITO-URINARY SYSTEM

Roentgenographic Survey of the Genito-Urinary Tract. James J. Clark. J. M. A. Georgia **37:** 80–82, March 1948.

A brief history of urography is presented, showing the remarkable progress made since 1897, when the first studies were attempted. The author then stresses the need for technical skill in cystoscopy and ureteral catheterization and knowledge in the use of modern x-ray equipment, as well as the ability to interpret the roentgenograms. His routine for intravenous urography is outlined, and the value of the preliminary survey film is stressed.

The author is of the opinion that with films of proper diagnostic quality, the intravenous method is equal in the usual case to the retrograde study.

EDWARD E. LEVINE, M.D.
Dearborn, Mich.

Studies on Back-Flow in Excretion Urography. Olle Olsson. Acta radiol., Supp. 70, 1948.

The term "pyelovenous backflow" came into use in connection with retrograde pyelography, and an extensive literature concerning the phenomenon has accumulated. In contrast, reports of back-flow in excretion urography are few in number. That it is by no means rare, however, is indicated by the author's review of 1,500 urograms, in which a distinct, though often small, back-flow was found in 37 instances (2.5 per cent).

The clinical material upon which the present study is based consists of 100 consecutive examinations by excretion urography in which back-flow was noted. In 94 of these cases this occurred after application of ureteral compression, the interval before its appearance averaging twenty minutes. In the remaining 6 cases it was associated with renal colic. The extravasation is of two forms. In a small group of 11 cases, streaks or lines were observed, extending more or less medially between the kidney and the spine. In the remainder of the series (89 cases), the extravasate was localized immediately adjacent to one or more calices, whence it spread in the sinus renalis around the renal pelvis and its branches, and occasionally out through the hilus.

On the basis of experimental injection of the kidneys the author believes (1) that back-flow has no connection with the circulatory system; (2) that back-flow as most commonly observed is limited to the sinus renalis and does not involve injection of urine into the circulation; (3) that blood-vessel spread of the opaque material is more common in postmortem specimens than in the living subject; (4) that the term back-flow for small sinus extravasates is not appropriate.

Clinically, the greatest significance of back-flow lies in its diagnostic and differential diagnostic value. The differential diagnosis of renal rupture and of renal tuberculosis are considered, and one case of renal tumor with back-flow is described.

The concluding chapter of this monograph is devoted to the association of renal colic and back-flow, as illustrated by the 6 cases mentioned above. In such cases back-flow is not the result of an extraneous factor but is an integral part of the patho-physiological unit constituting the colic. They furnish the first clear evidence that back-flow may be an integral part of a clinical picture.

Forty-two roentgenograms.

Sickle-Cell Disease with Severe Hematuria Simulating Renal Neoplasm. Martin S. Abel and Chester R. Brown. J. A. M. A. **136:** 624–625, Feb. 28, 1948.

Renal symptoms in sickle-cell anemia are of little importance until late in the disease, when one may find traces of albumin or urobilin in the urine, or a few casts. The renal pathology stems from the blockage of the small arterioles and capillaries by the sickle cells. The changes are due to stasis, thrombosis, infarcts, fibrosis, and ultimate glomeruli destruction.

The authors report a case with gross hematuria. Clinically, the patient, a Negro, complained also of sore throat and pain in the chest. On physical examination, there was a mild injection of the pharynx. Laboratory examinations demonstrated gross blood in the urine. Excretory and retrograde pyelograms showed incomplete and irregular filling of the left upper and middle calices, and the possibility of a tumor of the left renal pelvis was considered.

During the patient's stay in the hospital, left costovertebral angle pain developed, accompanied by hematuria. On cystoscopic examination the blood was found to come from the left ureter.

In view of the clinical, cystoscopic, and roentgen findings, a diagnosis of renal neoplasm was made, and a left

nephrectomy was undertaken. Gross findings were hemorrhages into the mucosal surface of the pelvis. Microscopic examination showed sickled and agglutinated erythrocytes in the dilated vessels of the pelvis. A few vessels had partially necrotic walls which were surrounded by masses of sickle cells.

This case is unusual, in that the patient had no clinical findings typical of sickle-cell anemia. No sickle cells were found in the peripheral circulation. The findings were compatible with a diagnosis of renal neoplasm. Pathological sections showed the sickle cells within and around the dilated pelvic blood vessels.

One roentgenogram; 1 photomicrograph.

S. B. FEINBERG, M.D.
University of Michigan

Retrocaval Ureter: Case Report. P. P. B. McElhinney and John W. Dorsey. J. Urol. **59:** 497–500, March 1948.

The authors present a proved case of retrocaval ureter, bringing to 37 the total number of cases reported in the medical literature.

The patient was a 20-year-old white male with a ten-day history of progressive, constant, dull, localized right flank pain, chills, fever, and moderate dyspnea. For one year previously, he had experienced occasional right flank pain, often with vomiting. He had been hospitalized for acute right pyelonephritis about a month prior to the present admission. Physical examination revealed tenderness in the right costovertebral angle and in the right hypochondrium. The temperature and white blood cell count were slightly elevated.

An excretory urogram showed a sickle-shaped deformity of the ureter, which has been described as characteristic of a retrocaval ureter. This was located at the level of the third lumbar vertebra on the right side, with dilatation of the ureter and pelvis proximal to the site of ureteral angulation. An attempt was made to catheterize the right ureter, but an impassable obstruction was encountered at 20 cm., which was the approximate level of the angulation. Pyelograms revealed a medial displacement of the catheterized right ureter, almost to the mid-line. A preoperative diagnosis was made of infected right hydronephrosis and hydroureter secondary to obstruction, probably due to an aberrant renal blood vessel.

At operation, the right ureter was found to pass down behind and around the inferior vena cava, and to be hung on a lumbar caval tributary, at which point the obstruction was most marked. It appears that this was the site of the angulation, and was on the right side before the ureter passed behind the vena cava, although the authors do not indicate this specifically. The ureter was divided, mobilized to a normal ante-caval position, and successfully re-anastomosed.

The authors indicate that in order to establish a preoperative diagnosis, one must be aware of this type of anomaly and the associated clinical symptomatology and roentgenographic signs.

Five roentgenograms.

D. B. NAGLE, M.D.
University of Pennsylvania

Iliac Lymphadenopathy as a Cause of Ureteral Obstruction. Victor F. Marshall and Morris Schnittman. Surgery **23:** 542–549, March 1948.

Lymph nodes large enough to be palpated or to displace regional viscera are frequently considered in the diagnosis of ureteral obstruction. The authors, however, have had occasion to study closely five patients with ureteral obstruction caused by only moderately enlarged iliac nodes. Four of the cases, proved at operation, are presented in some detail. One patient was found to have Hodgkin's disease that was not previously suspected and died fourteen months later of generalized disease. The remaining 3 gave histories of large bowel resections for carcinoma eight months to two years previously, and in all these cases the ureteral obstruction was demonstrated on pyeloureterograms obtained with the Woodruff technic. The fifth case, of which a brief history is also presented, was not proved at operation but the x-ray findings of ureteral obstruction at the pelvic brim and hydronephrosis were identical with those in the proved cases. The patient had been treated previously, with radiation, for cancer of the cervix.

In all these cases flank pain without significant urinary symptoms was the presenting complaint. Other interesting observations were: (1) a hydronephrotic or non-functioning kidney on the involved side; (2) ureteral obstruction consistently present at the pelvic brim, 9 to 10 cm. above the ureteral orifice; (3) a normal ureter below the constriction; (4) the length of the constriction, which never exceeded 3.0 mm. and was usually only 1.0 mm. The cause of the constriction was proved in each instance to be neoplastic involvement of the iliac lymph nodes.

If the features listed above are to be accepted as diagnostic of iliac lymphadenopathy, the recognized causes of ureteral obstruction at the pelvic brim must be excluded. Preoperatively the exclusion of idiopathic stricture offered some difficulty. Such strictures, however, are rarely so sharply demarcated and are unlikely to present so consistently at this specific level. Their chronicity is a further distinguishing point.

Fourteen roentgenograms.

JOSEPH D. CALHOUN, M.D.
University of Arkansas

Role of the External Urethral Sphincter in the Normal Bladder and Cord Bladder. John L. Emmett, Richard V. Daut, and J. Hartwell Dunn. J. Urol. **59:** 439–454, March 1948.

The authors believe that the so-called "cord bladder" eventually becomes hypertonic and trabeculated, and that this process at length involves the vesical neck, so that the vesical outlet is obstructed. A considerable proportion of these patients can be relieved of urinary retention by transurethral resection of the vesical neck. Some cases have been encountered, however, that have continued to show urinary obstruction after this procedure. In such cases the authors have felt that the external urethral sphincter might be a contributory factor and they report 3 cases in which suitable attention in this direction resulted in relief of obstruction.

In order to obtain more information as to function of the external urethral sphincter and a better understanding of its role in cases of the type under discussion, a cystourethrographic study was carried out on 15 persons—5 with no neurologic lesions and 10 with lesions of the spinal cord and associated vesical dysfunction. The technic of the examination is described and the results are presented. These indicated that continued obstruction was due to increased tonicity of the external urethral sphincter and suggested that this increased

tonicity may be a manifestation of the same factors which cause increased tonicity of the detrusor muscle, trabeculation of the bladder, and increased tonicity of the vesical neck.

Their observations are also believed by the authors to suggest some new avenues of therapeusis which warrant further exploration. In the case of the cord bladder in which trabeculation, increased tonicity, and urinary incontinence are present but the bladder does not contain any residual urine, the treatment must be directed toward increasing the strength of the external sphincter and weakening the vesical neck. The latter is easily accomplished by transurethral resection. The former as yet is not possible except in cases in which the patients are women and plastic operations on the urethra, such as the Kelly operation, furnish a crude but sometimes satisfactory solution of the problem. In the occasional case in which the hypertonic external urethral sphincter is sufficiently obstructive to prevent complete evacuation of the bladder, in spite of adequate transurethral resection of the vesical neck, several surgical procedures seem to be available: (1) bilateral section of the pudendal nerves, (2) intradural section of the roots of the 4th and 5th lumbar and 1st, 2nd, 3rd, 4th and 5th sacral nerves, (3) intraspinal alcohol injection.

Fifteen roentgenograms.

VERN W. RITTER, M.D.
University of Pennsylvania

FOREIGN BODIES

Fate of Metal Foreign Bodies in the Human Organism. Ivan Rodé. Radiol. Clin. (Basel) **17:** 78–83, March 1948. (In German.)

The author describes two unusual cases. In the first one a Kocher forceps had been left in the right lower abdomen of a female patient six years previously. For one year she was without clinical symptoms; then indefinite and vague gastro-intestinal complaints began. The roentgenogram revealed a partially destroyed Kocher forceps, apparently located medially and posteriorly to the ascending colon. Surgery was performed and parts of the forceps were found to be in the colon and other parts in the small intestine and soft tissues. It is believed that the instrument had gradually moved and worked itself into the intestine without causing an acute perforation. The surprising fact was that part of the instrument was destroyed and missing. This was particularly true of that portion of the instrument extending into the colon.

The second patient had sustained an injury to the thigh seventeen years earlier, and shrapnel fragments were present in the soft tissues. A cystic tumor was removed containing a gray-white, thick, oily material and many small lead particles.

The author calls attention to the fact that metals left in the tissues for a long period of time can be absorbed. and that under certain circumstances they may cause tumor formation.

Two roentgenograms; 1 photograph.

EUGENE F. LUTTERBECK, M.D.
Chicago, Ill.

TECHNIC

Use of a Mobile Source of Light in Radiography. Yrjö V. Paatero. Acta. radiol. **29:** 221–227, March 31, 1948.

The usefulness of the author's "slit method" is discussed, primariiy in relation to dental radiography. A single film is used for each jaw, specially shaped to fit the arch of the teeth. An intensifying screen is used since the beam is reduced to a narrow slit. The tube is set at the proper angle (the average of the various angles from incisors to molars) and the patient is rotated during the exposure to bring the central ray perpendicular to each portion of the film. The distance, kilovoltage, and milliamperage are not given, but the author states that an exposure can be made in eight seconds. Examples reproduced indicate that it is a practical method and would certainly simplify what is now a time-consuming process.

The author believes that this method is equally adaptable to roentgen examination of other parts of the body. "Out of a tube moving parallel to the plane of the film and fitted with a linear focus, a cluster of rays is sent out of a narrow lead slit through the object in the direction of the film." It is also suggested that accurate measurements in both planes could be made by using a grid to screen out the oblique rays in the direction of the slit. This would mean placing the grid at right angles to the slit and would of course cause even greater prolongation of the exposure time.

Two roentgenograms; 2 drawings.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Solution of Technical Problems Connected with Economical Light-Weight Apparatus for Mass Miniature Radiography. Kaj W. Noschis. Acta radiol. **29:** 268–276, March 31, 1948.

An inexpensive, light-weight, easily portable apparatus devised for mass radiography in Finland is described. It is called a "Penograph." One of the features is the elimination of high-tension cables by building a sort of chimney on the transformer of bakelite insulators and mounting the tube on top. This is detachable for transport. The control panel is also built onto the transformer. A special cassette holds 25 meters of film, enough for 1,050 exposures.

Since the budget would not permit the purchase or construction of a phototimer, a movable platform was built whose excursion depends upon the patient's weight. This is geared to the timer to provide longer exposures for the heavier patients. At the same time the use of gravity and counter-balances saves the expense and trouble of obtaining a motor. The height of the x-ray tube and the camera are always fixed.

The quality of the image is said to be the same as with standard apparatus. An account is included of a method of obtaining enlarged copies (80 to 100 mm.) of the separate images on the 24-mm. film.

Seven photographs.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

RADIOTHERAPY

Presentation and Analysis of the Results of Radiotherapy. J. W. Boag. Brit. J. Radiol. **21:** 128–138, March 1948; 189–203, April 1948.

This very important article presents a real advance in the analysis of cancer statistics. After pointing out some of the defects in present methods, the author chooses to consider the "survival time"—*i.e.*, the length of life after commencement of treatment, considering chiefly not the survivors, but the patients who died. For a general survey of results, he plots the individual case on a dot chart, with length of survival as ordinate, using a different code dot for alive and well, alive with disease, dead of intercurrent disease, and dead of cancer. It is then shown by several illustrative examples that if the number of patients who died in any given interval of time is plotted against the logarithm of the time, the resulting curve is a normal curve. Since the characteristics of this type of curve are well known, it is possible, by completing an incomplete curve, to estimate with a high degree of accuracy the number of patients who may be expected on an actuarial basis to die of disease over an indefinite time, and by subtracting these from the total an estimate of the true cure rate which closely approximates the actual figure is obtained. It is also possible to determine the time which must be allowed to elapse before practically all of those who are going to die of cancer will have done so, thus giving a natural figure to replace the arbitrary five-year interval now in fashion. In completing these curves, Boag shows by experiment that it is possible to predict with very high accuracy after so short an interval as a year or two, what the actual cure rate will be. Comparisons of various modes of treatment, and of results in various stages of disease are greatly facilitated and are much more accurate by this method of study than by any previously used.

The second portion of the article contains the formal mathematical proof of the various formulae proposed in the first, and will not greatly interest most physicians; it is of importance chiefly because it demonstrates that these matters are susceptible of rigorous proof.

Fourteen figures (graphs and diagrams); 12 tables.

LEWIS G. JACOBS, M.D.
Oakland, Calif.

Surgical Experience with Tumors of the Pituitary Gland. Francis C. Grant. J. A. M. A. **136:** 668–671, March 6, 1948.

Ten per cent of brain tumors seen on the Neurosurgical Service of the University and Graduate Hospitals, University of Pennsylvania, between Jan. 1, 1936, and Jan. 1, 1947, were of pituitary origin, either intrasellar adenomas or extrasellar craniopharyngiomas. The chief concern of the neurosurgeon, radiologist, or endocrinologist in treating these tumors is restoration or preservation of vision. It should be fully appreciated that glandular dysfunction resulting in amenorrhea, impotence, etc., cannot be materially benefited by any form of treatment.

Pituitary Adenomas: In the treatment of pituitary adenomas, visual acuity is used as a measure in determining the type of therapy. If the visual acuity is better than 6/9 in each eye, and if atrophy of the optic nerve is not advanced, radiation therapy is indicated. If visual acuity is less than 6/9 in either eye, especially if the impairment in vision has advanced with any speed, or if optic atrophy is pronounced in either eye, then surgery is the treatment of choice. Periodic postoperative, three-month check-up examinations to determine the effect of treatment on visual acuity are instituted. If there is progressive contraction of the temporal field or further loss of visual acuity, radiation therapy is promptly begun.

Seventy-one pituitary adenomas (61 chromophobic and 10 eosinophilic) were surgically treated with 85 operative exposures and 8 deaths, a case mortality of 11.2 per cent and an operative mortality of 9.4 per cent. Of the surviving 63 patients, only 55 returned for adequate periodic check-up.

In this series of 55 cases, no radiation therapy was given in 24; both surgery and radiotherapy were used in 31. In the group which received surgical treatment only, 14 patients had good results, with an average visual acuity improvement of from 34 to 58 per cent. The 10 in whom results are termed unsatisfactory had an average increase in visual acuity of from 29 to 44 per cent. In the group which received postoperative radiation therapy, 19 had improved visual acuity of from 32 to 68 per cent, and 12 of from 31 to 54 per cent. The combined therapy is considered definitely more satisfactory than surgery alone.

Operative technic is briefly discussed. Two of the 8 operative fatalities resulted from brain damage incurred in attempts to control hemorrhage from a ruptured carotid vessel. Two patients who failed to regain consciousness after operation showed at autopsy polyglandular failure, with atrophy of adrenal glands, thyroid, and ovaries or testes. One other case with a similar response to operation did not come to autopsy. In the 3 remaining fatal cases, in which death was accompanied by hyperthermia, the adenoma had spread beyond the sella to involve adjacent structures.

Craniopharyngiomas: The prognosis of craniopharyngiomas is poor. They apparently are entirely unresponsive to irradiation; consequently surgical attack is indicated. The problem in surgical treatment of craniopharyngioma is threefold: to escape hyperthermia from damage to the hypothalamus, to prevent complete glandular collapse after operation, and to avoid damage to the carotid artery. Operative mortality is high, in this series 35 per cent of 30 cases.

Three tables.

T. P. GLYNN, M.D.
University of Michigan

Cancer of the Larynx and Hypopharynx. Galen M. Tice and Charles M. White. J. Kansas M. Soc. **49:** 93–97, March 1948.

From 1935 to 1947, 52 cases of cancer of the larynx were given x-ray therapy at the University of Kansas Hospital. Thirty-four cases received roentgen irradiation alone; in 14 patients, irradiation followed laryngectomy, and in 4 it followed laryngofissure. The method of treatment was similar to that employed elsewhere except that the total dose of radiation was a little higher. This series was made up for the most part of patients who were in or nearing the hopeless stage. Of the 34 patients treated by x-ray alone, 21 required tracheotomy before treatment or had palpable cervical nodes. For the entire series, there were 23.4 per cent two-year arrests and 19 per cent five-year arrests; for

the 34 patients treated with x-ray alone, there were 19 per cent two-year arrests and 10 per cent five-year arrests.

The following conclusions are reached: (1) Cancer of the endolarynx gives symptoms early and has a high rate of curability. Cancer of the laryngopharynx produces symptoms late but it is usually radiosensitive and responds quite well to irradiation. (2) The radiosensitivity of cancer of the larynx depends more on its site of origin than on its histology. (3) The two most important features in treatment are: (*a*) selection of the type of treatment for the patient, *i.e.*, irradiation or surgery depending upon the origin and extent of the cancer; (*b*) technic of treatment (200 kv. most generally used, with a tumor dose of 4,000 to 5,000 r in about thirty to forty days). (4) In early properly selected cases laryngofissure gives better statistical results than irradiation. In patients requiring laryngectomy, irradiation will give as good results as the indicated surgery. (5) Irradiation results in about 20 per cent of five-year cures in inoperable advanced cases of cancer of the larynx.

One table.

Mammary Cancer. The Place of Surgery and of Radiotherapy in Its Management. G. E. Richards. **Part I. A Study of Some of the Factors Which Determine Success or Failure in Treatment.** Brit. J. Radiol. **21:** 109–127, March 1948. **Part II. Radiotherapeutic Procedures.** Ibid. **21:** 249–258, May 1948.

The present study is based upon 1,271 cases observed from 1933 to 1943. Attention was paid particularly to three questions: (1) Is breast cancer more malignant and results less satisfactory in younger women than in older? (2) Does the induction of an artificial menopause exert a favorable influence on the course of the disease? (3) Can primary lesions be eradicated by means of radiotherapy?

Radical mastectomy, when properly performed, is one of the best methods of treatment. In spite of many carefully collected statistics, really significant figures of survival after this method are difficult to find, because of different criteria used. The range is from 22.2 to 36.9 per cent five-year survivals.

Radiotherapy has been used chiefly as a postoperative procedure. In this series, 81 per cent of 147 patients with Stage I disease treated by radical mastectomy followed by intensive radiotherapy survived five years. Theoretically 100 per cent should survive mastectomy. The average figure, however, for survival after surgery alone is 70 per cent. This means that in that percentage no postoperative radiation is necessary, but in 30 per cent it is urgently needed.

In Stage II cases the average survival rate is 25 to 30 per cent with surgery alone. With postoperative irradiation the figure rises to 43 per cent, indicating that it is justified as a routine procedure.

Surgery alone in Stage III gives only 5 per cent survivals. By heroic radiotherapy this can be raised to 13 per cent. Even though these patients are carried beyond the five-year period, they are seldom cured.

Against the figures for Stage II and Stage III cases given above must be placed the survivals in untreated cases. Twenty-two per cent of a series reported by Daland (Surg., Gynec. & Obst. **44:** 264, 1927) survived five years or more, and of these several were still living at ten years. These figures indicate that there is little cause for satisfaction in the results of our methods of treatment.

Certain factors exert an important influence on the outcome in mammary cancer: the clinical stage of the disease, the rate of growth and duration, the age of the patient, the type of cancer, the influence of ovarian function, pregnancy and lactation, and the type of treatment. The influence of some of these factors is obvious. Tumor grading histologically has not proved a reliable guide. Study of the figures for various age groups show that there is not a significant difference, so there is no justification in the statement that the prognosis is worse in the young, purely on the basis of age. In 32 cases an artificial menopause was induced. This produced only a 9 per cent increase in survivals. This improvement is so small that sterilization probably should not be insisted upon in the face of objections, either personal or religious. Pregnancy and lactation, if concurrent with the discovery and treatment, give a poor prognosis. Occurring after treatment, they have little effect.

Preoperative therapy was given in 82 cases. The lesion disappeared from the breast in 25 per cent of these, from the axilla in 35 per cent and from the supraclavicular area in 50 per cent. If subsequent surgery was not done for at least six weeks, there was no interference with healing. The survival rates were slightly better in the patients having preoperative irradiation.

From these studies, certain conclusions may be drawn as to the handling of these cases. In Stage I radical mastectomy should be done, followed by irradiation in selected cases. In Stages II and III preoperative irradiation should be followed by surgery and in selected cases postoperative irradiation should also be given. In Stages IV and V radiological treatment is indicated primarily, a few of these cases becoming suitable for operation later.

Survival rates to be expected in Stage I are 75 to 90 per cent; in Stages II and III, 65 to 70 per cent; and in the advanced cases 35 to 43 per cent.

The author's method of treatment entails the following factors: 400 kv., 0.6 mm. Sn filtration, distance 100 cm., h.v.l. 4.5 mm. Cu, 10 r/min. The depth dose at 10 cm. is 37 per cent.

Four tangential fields are used for the primary lesion, four (anteroposterior, postero-anterior, direct and superior) for the axilla, and three converging beams, preferably using teleradium, for the supraclavicular area. Depth dose charts are given for each of these areas.

Eighteen photographs; 7 treatment charts; 1 case record; 14 tables.

SYDNEY J. HAWLEY, M.D.
Seattle, Wash.

Is Chronic Cystic Mastitis a Precancerous Lesion? Ten Year Follow-Up Study of Twenty-Six Cases. H. Lester Reed. Arch. Surg. **56:** 338–344, March 1948.

The author followed 26 cases of chronic cystic mastitis from ten to seventeen years. He distinguishes three types pathologically: 20 of the patients were of the "simple" type and 6 of the other two types, which show slight neoplastic tendencies as determined microscopically. Treatment of the "simple" type was by excision; of the others by mastectomy. Of the 26, not one patient developed cancer of the breast; 2 died of other diseases, and 24 were alive and well at last notice.

Six photomicrographs; 1 table.

LEWIS G. JACOBS, M.D.
Oakland, Calif.

Cytologic Method in the Diagnosis of Cancer. Maurice Fremont-Smith, Ruth M. Graham, and Joe V. Meigs. New England J. Med. **238:** 179–181, Feb. 5, 1948.

[While this paper is not directly concerned with radiation therapy of cancer, it will be of interest to radiotherapists because of the importance of establishing an accurate diagnosis.—Ed.]

Since the popularization of the cytologic method in the diagnosis of cancer, 3,710 cases have been studied by vaginal smear with a diagnostic error of 2.8 per cent. Of 285 carcinomas of the cervix, 31 were missed by smear and of 98 endometrial carcinomas, 20 were missed by smear. The diagnosis of very early carcinomas of the cervix by vaginal smear is more accurate than by biopsy, since several areas must be biopsied and often these will miss the cellular change.

In pulmonary carcinoma, the sputum may contain cancer cells. In 7 cases of operable carcinoma of the lung, the sputum of 6 contained cancer cells.

In cancer of the urinary tract, the cancer cells may sometimes be defined in the urinary sediment.

Gastric cancer can sometimes be diagnosed before the tumor is visible by x-ray or even at operation. The gastric fluid will contain the cancer cells and establish the diagnosis.

JOHN B. MCANENY, M.D.
Johnstown, Penna.

Influence of Castration by Roentgen on Carcinoma of the Breast. Viggo E. Thayssen. Acta radiol. **29:** 189–204, March 31, 1948.

The author made a comparative study of two series of cases of breast cancer with metastasis or recurrence. One group of 99 patients received, in addition to other treatment, irradiation of the ovaries. A control group of 100 cases were not subjected to roentgen castration. A definite lengthening of life was observed in the castrated cases: 40 per cent survived two years or longer after the appearance of metastases as compared with 11 per cent of the controls. Five years after the appearance of metastases, 20 per cent of the castrated were still alive, but all of the control group had died. If only the cases receiving preoperative or postoperative roentgen therapy are considered and the survivals are reckoned from the time of operation, the five-year figures are 28 per cent for the castrated and 8 per cent for the controls.

Urine assays showed that gonadotropin levels reached the same high values and estrogen the same low levels after roentgen castration as in the natural menopause.

From his experience the author gives his indications for using roentgen castration. He uses it in cases with metastases and those in which radical surgery is impossible. He is against using it as a routine measure since it would prove to be unnecessary in many cases, and more important, this would rob one of a very useful procedure should metastases occur, since repeating the dose later will not bring any improvement. It may be used as late as five to ten years after the natural menopause.

The author was unable to find any criteria which might prove of value in selecting the cases more likely to benefit from castration. The age of the patient, microscopic picture, and hormone assays were all useless in this respect.

Four roentgenograms; 2 graphs; 2 tables.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Carcinoma of the Cervix Treated by Combined Radiation and Surgery. J. Reed Babcock. Pennsylvania M. J. **51:** 626–627, March 1948.

The results of treatment of carcinoma of the cervix by irradiation have been discouraging because of the high percentage of recurrence. With the hope of increasing the percentage of cures, the author has been doing a complete hysterectomy in selected cases after preliminary radium therapy—5,400 to 6,000 mg. hours, using 50 mg. of radium. It was found that with a small amount of radium over a relatively long period of time there was less radiation cystitis and proctitis. Hysterectomy is performed six to twelve weeks after the insertion of radium.

An attempt is made to compare the results of radium and surgery and radium and x-ray during a five-year period. The results appear to favor the former method, but the author concedes that a comparison may be unfair, since patients considered unsuitable for surgery were irradiated.

JOSEPH T. DANZER, M.D.
Oil City, Penna.

Results and Causes of Failure of Radiation Therapy in Carcinoma of the Cervix. Henry S. Kaplan, Hugh M. Wilson, and Arthur H. Morse. Surg., Gynec. & Obst. **86:** 332–340, March 1948.

The authors review 88 cases of carcinoma of the cervix treated with combined x-ray and radium therapy. The age range was between twenty-five and eighty-one years, with over half of the patients in the fifth and sixth decades. Age, however, played little part in the final five-year results.

Roentgen therapy was given first, through a total of 6 portals (2 anterior, 2 posterior, and 2 lateral), usually measuring 10 × 15 cm. The head of the femur was shielded on the anterior and posterior portals. Physical factors were: 200 kv.p., 20 ma., 70 cm. distance, 0.5 mm. copper plus 1.0 mm. aluminum filtration. The dosage to each portal was 1,500 to 1,800 r, measured in air, over a period of three to four weeks. About four to six weeks after completion of roentgen therapy, a total of 6,000 mg. hours of radium therapy were given, the dosage being equally divided between a cervical canal tandem and conventional colpostat. Seventeen cases did not receive radium therapy. In their subsequent discussion the authors state that a shortening of the period between the roentgen and radium treatment to two weeks is desirable, though this shorter interval may be expected to result in a greater incidence of radiation injuries.

The five-year survival rates were 69 per cent for Stage I, 47 per cent for Stage II, 4 per cent for Stage III, and none for Stage IV, with a net survival rate for the entire series of 38 per cent. The League of Nations classification was used. Thirteen patients, 23 per cent of those dying of cancer, were found at autopsy to have distant metastases.

The authors believe that external irradiation in Stage I adds little or nothing and can be omitted, as the statistical results are no better than with radium alone. Patients who did not receive any radium therapy, or who were given only an incomplete course in addition to the external radiation, showed a much poorer survival rate, and for this reason it is believed that radium therapy should not be omitted even in the advanced cases, except under extreme circumstances.

Various radium methods are discussed, with unfavor-

able comment on the use of needles. Roentgen therapy is believed to be of less value than radium. The Wertheim operation gives good results in a few skilled hands in early selected cases. It is these cases, however, that also give good results with irradiation. It is doubtful if radiation alone can completely destroy pelvic node metastases, and the authors propose extraperitoneal lymphadenectomy as offering a possible advantage.

Three tables.

ARTHUR W. PRYDE, M.D.
University of Pennsylvania

Wilms' Tumors. Hans R. Sauer. New York State J. Med. **48:** 497–501, March 1, 1948.

Sauer reviews 16 cases of Wilms' tumor seen over a thirty-year period, the incidence being 1 case in 3,500 admissions. Of the 16 patients, 15 died and 1 is well ten years after treatment by radiation alone.

The most frequent symptoms were an abdominal mass and abdominal pain. The average period between the initial appearance of symptoms and recognition of the lesion was two and a half months; in 81 per cent of the series the interval was less than two months. This roughly parallels the observation of Campbell (Pediatric Urology, New York, Macmillan Co., 1937. Vol. II), who reported an interval of less than two months in 37 of 47 patients. Rapid progression of the lesion after onset of symptoms is the usual rule; hence metastases are often present when the original tumor is discovered. The author warns against aspiration biopsy or exploratory biopsy because of destruction of continuity of the tumor capsule and consequent increase in the chances for metastasis and decrease of the possibility for cure. Readily accessible metastatic lesions should be biopsied, however, since sometimes the clinical diagnosis may thus be confirmed before the original tumor is palpable.

As to the preferable method of treatment, the author draws no conclusions. He quotes results obtained by surgery without irradiation and by irradiation alone. He feels that therapy should be selected according to the individual case and favors immediate removal of the tumor followed by irradiation, except in those cases in which irradiation must be used to reduce the size of the tumor in order to make it amenable to surgery.

Two roentgenograms; 2 photographs.

ROBERT C. PENDERGRASS, M.D.
Americus, Ga.

A Foolproof Radium Technic for Treatment of Hemangiomas. George Clinton Andrews. J. Invest. Dermat. **10:** 95–97, March 1948.

The author believes that radium treatment, if properly carried out, gives the best cosmetic results in most hemangiomas, though injection of sclerosing solutions, refrigeration with solid carbon dioxide, roentgen therapy and surgical excision have their uses in some cases. Nevus flammeus (port wine stain) should not be treated with radium.

Andrews describes his method of treatment as simple and foolproof. It is simple because only standard radium plaques are used and it is safe because radiation is almost entirely absorbed in the upper 2 or 3 mm. of tissue. The depth dose at 2 mm. is only 25 per cent of the surface dose. There is no danger, with this technic, of injuring underlying structures. The therapeutic dose is so standardized that there is no risk of skin injury.

Half-strength or full-strength flat glazed or monel metal-covered square plaques, 20 × 20 mm., are used. Each plaque is covered by a tray-shaped 2 mm. brass filter, extending up over the sides of the plaque, where the thickness is 1 mm. When several plaques are placed side by side on a strip of adhesive plaster they make a flexible applicator which will fit over the shoulder or around an extremity with ease. Any number of plaques may be used, so that the size of the applicator can be made appropriate for any angioma. There is no danger of cross-firing or overlapping from one plaque to another. Full-strength plaques (5 mg. radium per square cm.) are left on the skin for three and one half hours. Half-strength plaques are left on for seven hours. Treatments are repeated no oftener than once every three months. No more than four such treatments should be given any angioma; often two or three treatments suffice. Rarely some remnant may persist after four treatments. This may be due to lack of coaptation of the plaque to the angioma.

Treatment of Keloids at Radiumhemmet 1921–1941. Folke Jacobsson. Acta radiol. **29:** 251–267, March 31, 1948.

The primary etiology of keloid formation is still unknown. Keloids follow some type of trauma to the skin (thermal, inflammatory, surgical, etc.), but a few are seen where no known trauma has taken place. It is possible that here the trauma was so slight that the skin was not broken and the incident was forgotten.

The treatment of choice is radium or roentgen therapy. The author uses a technic elaborated and described by Strandqvist (Acta radiol. **20:** 1, 1939). A dose of 850 to 1,000 gamma roentgens calculated at a depth of 3 mm. is used. This is given only once. Filtration equivalent to 0.5 mm. platinum is employed; the distance is 4.5 mm. The best results are obtained in those cases in which the duration of the keloid is less than one year.

Of the author's series of 625 cases, 549 were treated by radium, 24 by radium and roentgen rays, 25 by roentgen rays alone, and 27 by excision and prophylactic irradiation. The dosage of radium has varied somewhat over the years. Ninety-seven per cent of the cases showed moderate to complete regression; 3 per cent, slight or none.

The author does not favor the combination of surgery and postoperative prophylactic therapy, stating that the cosmetic result is not so good. He is content to wait a long time for results, as evidenced by the remark that if pronounced itching and pain are still present and no regression of the keloid has taken place after one to one and a half years, a second treatment is given. This seems extremely conservative, but he says that regression may still take place after an interval of that length.

Three photographs; 1 graph; 7 tables.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Treatment of Keloids by Irradiation and Electrosurgery. George E. Pfahler and George P. Keefer. Am. J. Roentgenol. **59:** 378–386, March 1948.

The authors review the indications, methods, and results of treatment of keloids and present several illustrative cases. If one can institute treatment within a month or two after hypertrophy of a scar has been recognized, the keloidal tendency will usually be arrested by irradiation alone. Treatment is given at 125 kv. In all instances, the larger the area involved the less must

be the individual dose and the more frequently it should be repeated. Thus, in treating a lesion of the upper lip 5 mm. in diameter, it is safe to give 80 to 100 per cent of an erythema dose at once, repeating it in a month or two, but if the lesion measures 5 or 10 cm. in diameter, it should receive a 25 per cent dose at weekly intervals or a 50 per cent dose at intervals of two weeks.

For older keloids, removal by the scalpel, electrosurgery, or electrodesiccation is recommended, with postoperative irradiation. In general, roentgen treatment is given shortly after removal, 80 per cent of an erythema dose being given at 125 kv., with 1 or 2 mm. aluminum filtration depending on the thickness of the lesion (this does not interfere with healing in any way). In two weeks the dose is repeated. If the wound is healing by granulation 50 per cent of an erythema is given in two more weeks. After that the lesion is inspected every two to four weeks and treatment is given when any sign of hypertrophy appears.

In some locations treatment of keloids is more easily carried out by radium. If the keloid is more than 1 or 2 mm. in thickness, only gamma rays should be used.

Twenty-one photographs.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Juvenile Nasopharyngeal Angiofibroma. Hayes Martin, Harry E. Ehrlich, and Jules C. Abels. Ann. Surg. **127**: 513–536, March 1948.

The thesis is advanced by the authors that juvenile nasopharyngeal fibroma occurs only in pubescent males. For other reasons, namely its spontaneous or readily induced regression with the appearance of full sexual development, a sex-endocrine relationship for this tumor probably exists. Although its histogenesis has not been definitely established, a vascular origin is proposed in this report. This proposal is based on specific involutional changes which can be induced with male sex hormone therapy and irradiation. The induction of vascular changes by hormone administration has considerable experimental support.

The histories of the 29 cases in the authors' series reveal that the correct diagnosis was seldom made by the physician first consulted. Although the tumor is admittedly rare and on the basis of incidence will not be recognized by the casual examiner, nevertheless, the unique anatomic and clinical setting should plainly suggest the possibility of nasopharyngeal fibroma. The syndrome of rapidly progressive nasal obstruction and recurrent severe nosebleeds in pubescent and adolescent males, plus the presence of a discrete ovoid or club-shaped, smooth, vascular, and usually bulky nasopharyngeal mass, which has grown forward to block one or both choanae, warrants a clinical diagnosis of nasopharyngeal fibroma. Only by mirror examination of the nasopharynx through the open mouth, occasionally supplemented by direct rhinopharyngoscopic examination through the anterior nares, can the tumor be visualized and its essential character appreciated.

Stereoscopic radiographic examination of the base of the skull, paranasal sinuses, and nasopharynx is not only of value in determining the exact location and extent of the tumor, but is especially important in the differential diagnosis where a bulky growth in the head has brought about considerable deformity of the face or unilateral exophthalmos.

Nasopharyngeal fibroma must be differentiated from choanal polyps, pharyngeal tonsil (adenoids), and benign minor salivary gland tumors, carcinoma, and malignant lymphomas. Chordoma of the upper cervical vertebrae, malignant tumors of the nasal accessory sinuses, and primary osseous neoplasms of the maxilla may produce nasal obstruction, epistaxis, and facial asymmetry, but by careful physical and roentgenographic examination these lesions can be tentatively diagnosed and differentiated from nasopharyngeal fibroma with little difficulty. An effort should always be made to establish the diagnosis by biopsy.

Though essentially benign, nasopharyngeal fibroma frequently produces serious and disabling symptoms because of its progressive growth and tendency to profuse hemorrhage. Once the diagnosis has been established, a therapeutic program should be adopted, subject to change as required by ensuing clinical developments. There is no one type of treatment which is a panacea for any given case, and in practically all instances a combination of methods must be employed. Aside from periodic examination, an active therapeutic regimen is not indicated for the occasional case where an asymptomatic tumor is discovered during routine physical examination. In the absence of nasal obstruction, nose bleeds, impairment of hearing, infection of the paranasal sinuses or middle ear, facial deformity, exophthalmos, headache, or significantly increased vascularity of the neoplasm, a policy of watchful waiting is justified. This policy was followed in one of the authors' patients, aged fifteen on admission, and during a two-year period of observation the growth remained stationary and asymptomatic.

Endocrine therapy was the only form of treatment in one case. In 10 others it was combined with some form of radiation therapy, surgery, or both. With the combination of methods, sex hormone therapy was either utilized alone as the initial treatment and, following its failure to control the growth satisfactorily, radiation therapy was instituted, or both forms of treatment were begun simultaneously. While no definite regression of the tumor was noted in any case in which the patient received only male sex hormone, it is thought that hemorrhages usually diminished in frequency and severity following such treatment.

In the present series, some form of radiation therapy, either alone or combined with one or more surgical procedures, was resorted to in 23 cases. In 9 of these, roentgen therapy was the only form of radiation employed and in this group late complications (dryness of nasopharynx, atrophy of maxillae, coarsening of features, attributable to the high dosages used to control the tumor), were frequent, indicating that no one method of treatment can be depended on without courting the hazard of over-aggressiveness. Because of its possible effect on the growth centers of the facial bones, roentgen radiation should preferably be reserved for patients eighteen years of age or older.

Interstitial radiation therapy was employed alone in 5 cases and was followed by serious complications in 3 instances. In one, necrosis of the hard palate resulted, due to unnecessarily large dose of gold seeds (total of 34 mc. inserted at three sittings over a period of two years). In 2, even more unfortunate developments followed massive doses of interstitial radiation (total dose of 32 mc. in one; 20 mc. in another) after administration of 3,000 r of 200-kv. roentgen radiation through a single 6-cm. cheek portal. In both patients extensive osteonecrosis developed, extending into the sphenoid bone, and death from brain abscess ensued.

On the basis of their experience, the authors state that, as a rule, smaller doses of interstitial and roentgen radiation will effectively control symptoms if the patient is receiving continued and adequate endocrine therapy, that bulky tumors producing facial deformity or exophthalmos are followed by no complications when treated by primary surgical excision (4 cases), and that residual tumors can be readily controlled with small doses of gold seeds inserted at frequent intervals.

During the period of radiation therapy, suppuration in the nasal accessory sinuses or middle ear occasionally supervenes and rarely mastoiditis may occur.

Of the 29 patients with nasopharyngeal fibroma in the series, 2, as stated above, died from brain abscess due to over-dosage with interstitial radiation, and one from acute rheumatic fever just after the onset of treatment.

Three photographs; 3 photomicrographs; 2 drawings.

RADIOACTIVE ISOTOPES

Therapeutic Use of Radioactive Elements in Malignancy. P. F. Hahn and C. W. Sheppard. Ann. Int. Med. **28:** 598–606, March 1948.

The following criteria for therapeutic usefulness of radioactive isotopes must be satisfied.

(1) The half-life must not be too long. Neither should an associated component of long half-life or a long-lived contaminant be present whose separation is difficult or impossible to effect. Ten days is arbitrarily set as the upper limit of half-life.

(2) The half-life must be sufficiently long so that the isotope can perform its work. The lower limits of half-life must temporarily be dictated by shipping facilities. Two days represents the minimum at this time.

(3 and 4) The biological behavior of the material should be well established since its effectiveness from a standpoint of localization is involved. The chemistry also should be well understood.

(5) The radiation spectrum of the isotope should be established and proper cognizance of the relative beta and gamma radiation to be delivered into the tissue taken into account. If a hard gamma ray is emitted, proper shielding in shipment and in the laboratory becomes more difficult.

(6) The radioactive material should preferentially be deposited selectively in the tissues to be treated.

(7) If the isotope is toxic, specific activity becomes important in keeping the dosage well under toxic limits.

Though some 450 radioactive isotopes are known, only a few hold promise of use as therapeutic agents. About half a dozen deserve critical investigation and appraisal at this time. Later the list may be increased slightly in length as it becomes feasible to utilize some of the shorter-lived materials.

Na^{24}: Sodium in ionizable form is uniformly distributed in the extracellular water of the body some hours following the administration of sodium chloride orally or by vein. The chief advantage in the use of Na^{24} would be the possibility of extending the radiation period for many hours. On the debit side is the difficulty of shipping and handling because of the exceptionally hard gamma ray emitted.

The use of *P^{32}* as a therapeutic agent has been most conspicuous in the treatment of polycythemia vera and possibly in myelogenous leukemia.

Cu^{64} is a good example of an isotope which may at some time in the future offer possibilities in therapy. It is an element closely associated with certain enzyme systems and is somewhat selectively taken up by certain tissues. Its short half-life precludes its widespread successful use at this time.

As^{74} is an example of a debatable element for inclusion in a list of therapeutic agents. Because of its toxicity, the low specific activity is against its use. However, it possesses some degree of selectivity in deposition in tissues; large amounts are commonly administered in antisyphilitic therapy. All in all, more study should be devoted to its possibilities before condemning it.

Yttrium^{90}, because of its hard pure beta particle spectrum should be an exceedingly useful substitute for *P^{32}* or long-lived strontium in the treatment of diseases of the bone and marrow, such as myelogenous leukemia, Ewing's tumor, and bone sarcoma.

I^{130} and *I^{131}* have been investigated fairly thoroughly and will probably play an increasing role in handling of certain diseases of the thyroid.

Au^{198} has only recently been tried as a therapeutic agent. It is too early to determine its full value in therapeutic use, though it has many desirable characteristics. It is easily made in pure form without any trace of discernible contaminant isotope. Its chemistry is unique and well understood. Its insolubility as a metal allows it to be injected with reasonable assurance that it will stay at the site of injection when given subcutaneously or intramuscularly. It is not subject to excretion when administered as the metal. Therefore it does not give rise to problems of radioactive excreta or loss from the body with accompanying lowered efficiency and uncertainty as to dosage.

A list of suggested technics for isotope therapy is presented, though a number of these have not yet been tried clinically. Briefly, they are as follows:

(1) For general body irradiation, to correspond to spray irradiation.

(2) Utilization of the peculiar affinity of a tissue for a given isotope in order to obtain localized irradiation.

(3) Utilization of chemical affinity for an element and substitution of another element of similar behavior physiologically but with a more suitable spectrum, half life, or other characteristic.

(4) Utilization of the semi-specific uptake of elements by tissues where some degree of generalized irradiation is desirable or is not strongly contraindicated.

(5) Utilization of specific functions of certain tissues in their physico-chemical behavior toward administered materials.

(6) Topical application in therapy of superficial lesions.

(7) Treatment of tumors of the hollow viscera by instillation of radioactive materials to obtain radiation by proximity.

(8) Selective therapy of specific organs or tissues, making use of specific action of certain drugs to manipulate the progress of the isotopic material.

(9) Therapy of pulmonary carcinoma by direct inhalation of radioactive material.

(10) Direct irradiation of discrete masses of tumor tis-

sue by infiltration of the tumor with an inert, insoluble isotopic material such as Au or Ag.

(11) Physical manipulation in localization of the distribution of radioactive material.

One table. STEPHEN N. TAGER, M.D.
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Chronic Myelogenous Leukemia. A Study of 129 Cases in Which Treatment Was with Radioactive Phosphorus. John H. Lawrence, R. Lowry Dobson, B. V. A. Low-Beer, and Bruce R. Brown. J. A. M. A. 136: 672–677, March 6, 1948.

This publication from the University of California reports experience in 129 cases of chronic myelogenous leukemia treated with radioactive phosphorus. The postulated equal or greater effectiveness and advantages of P^{32} (as compared to total body irradiation) are based on the experimental demonstration of its greatest concentration in the infiltrated bone marrow and soft tissues, thus approaching the ideal of delivering a maximum of radiation to the pathologic tissues with a minimum exposure to normal ones. The low half-value layer of tissue, 2 mm., of the beta rays emitted by P^{32} fulfills an additional requirement.

Dosage determination falls into two main categories (aside from animal experiments); correlation with doses given by 200-kv. total-body irradiation, using for comparison the estimation that one microcurie of P^{32} per gram of tissue will give 40 r of radiation in twenty-four hours and, of course, the clinical and hematologic response. In connection with the first mentioned, the authors give and discuss formulas derived by Tobias. These relate the quantity of P^{32}, injected or ingested, to equivalent roentgens of whole body irradiation.

For oral administration, total dose in roentgens equivalent physical =

$$N \times T \times 1.44 \times 0.38 \times \frac{40}{\text{weight in grams}}$$

N = microcuries, T the half life, 1.44 the integration factor over infinite time, 0.38 absorption and excretion rates, 40 the initial dose rate (40 r/gram of tissue/24 hours). For intravenous administration, the absorption and excretion factor 0.52 is substituted. It should be pointed out that the above calculations are based on an assumption of uniform distribution.

In general, doses have been from 1 to 2 millicuries once or twice a week for four to eight weeks, but doses equivalent to 40 millicuries intravenously over seventy-two days have been given. As with other forms of therapy, there is a wide individual variation. Such factors as the greater retention of phosphate on intravenous administration and the loss of considerable amounts through the gastro-intestinal tract if the patient is taking iron must be considered.

Of the 129 cases treated, about one-half had received previous x-ray therapy. Many of the patients were in poor condition. Approximately 1/10 of those initially given P^{32} received subsequent x-radiation, either because of poor response or desirability of treating localized areas. Prophylactic administration and attainment of a normal blood count did not prove a wise procedure. Extremely small doses or none were given in patients with a red cell count below 2,500,000, local roentgen irradiation to the spleen or other regions being sometimes substituted.

Safety and tolerance are indicated by the long periods over which some patients received P^{32}, several intermittently for as long as five to ten years. There was no evidence of the induction of neoplasms, such as bone tumor.

In summary, the authors state that the two definite advantages of P^{32} are the ease with which it provides generalized radiation and the lack of radiation sickness. The end-results are comparable to those of roentgen irradiation—comfortable life is prolonged.

Seven charts. O. C. MEHL, M.D.
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EXPERIMENTAL STUDIES

Effect of Roentgen Therapy on Experimental Ocular Vaccinia in Nonimmune and in Partially Immune Rabbits. George T. Harrell, Charles H. Reid, J. Maxwell Little, James W. Mankin, Hal W. Pittman, Lawrence Byerly Holt, and Leslie M. Morris. Arch. Ophth. 39: 313–324, March 1948.

The effect of direct irradiation at different stages of ocular vaccinia in non-immune and partially immune rabbits was studied, as well as the non-specific effect of irradiation of a distant primary lesion.

In preliminary experiments, roentgen therapy was administered with the following factors: 100 kv., 5 ma., distance 20 cm., portal diameter 2.5 cm., no filter except the 0.5 mm. of aluminum inherent in the tube, exposure 30 seconds. The half-value layer equaled 0.8 mm. of aluminum. All animals except those in one group were treated three times, receiving 102 r in air per treatment; because of technical difficulties the rabbits in the one group received only two treatments. In subsequent experiments the factors were slightly altered, so that 120 kv. at a distance of 21 cm. was used; the half-value layer then equaled 0.94 mm. of aluminum, and the animals received 105 r in air at each treatment.

The authors' comments on the value of roentgen therapy are as follows: Roentgen therapy appeared to be of value in the treatment of acute lesions of ocular vaccinia, as judged by clinical observation. The clinical impression that roentgen therapy may be valuable in decreasing residual corneal opacities was not borne out by experiments on the transmission of light, utilizing a photoelectric technic. Roentgen therapy would appear to have the same value in the treatment of secondary as of primary vaccinia; immunity did not appear to enhance the value of roentgen therapy for either acute or chronic lesions. The values for the means of the decrease in transmission of light might suggest that roentgen therapy was harmful; this is not borne out by the statistical comparison. The differences in transmission between the corneas of uninfected but traumatized animals which were irradiated and the corneas which were not irradiated, between the corneas of control and irradiated groups with primary vaccinia, and between the two groups with secondary vaccinia, were so small that it was concluded that roentgen therapy was not harmful and did not increase corneal opacities.

Four tables; 2 charts; 8 photographs.

Clinical Manifestations of Acute Radiation Illness Produced in Goats by Exposure to an Atomic Bomb, Test Able, Bikini, 1946, with Comments on Therapy. Eugene P. Cronkite. Nav. M. Research Institute, National Nav. Med. Center, Bethesda, Md. Project NM 007 039, Report No. 10, 1948.

It is pointed out that the effects of ionizing radiation produced by explosion of an atomic bomb cannot be duplicated by other means, such as x-ray tubes, radium, artificial radioisotopes, cyclotrons, or a chain-reacting pile, because of their inadequate output and small radiation fields. Therefore, a unique opportunity was afforded by Operation Crossroads.

Goats were used with varying degrees of shielding and obviously were subjected to a high dosage of short duration of gamma radiation and, to a lesser extent, to fast and slow neutron radiation. The animals considered in this report are those that were exposed to ionizing radiations ranging from 100 to more than 10,000 r (undoubtedly the author means roentgen equivalent mammal or r.e.m.).

The animals are divided into four groups: Group I, severest radiation illness; Group II, severe radiation illness; Group III, less severe radiation, illness; Group IV, mild radiation illness. Twenty-two goats served as controls and were kept aboard the laboratory ship at all times. It is pointed out that while this is not a true control group, because it was not subjected to all of the hazards of transportation and handling which the irradiated goats received, it at least gives some base line for comparison.

In the discussion, the author points out that Group I can be classified as having received over 1,000 r; Group II as having received approximately 1,000 r; Group III, less than 1,000 r but more than 100 r; Group IV, almost 100 r.

From an analysis of the data that are available, it is apparent that the mortality, the survival time, the appearance and duration of signs, the tempo at which radiation illness progresses, blood counts, and blood coagulation defects are in a general sense related to dosage of ionizing radiation.

Prognostic signs for recovery or death are not clearly defined. The leukocyte counts are of some assistance; a rapid decrease to less than 2,000 in the first forty-eight hours was usually followed by death before the sixth day. Most goats whose leukocyte counts remained above 2,000 during the first six days survived. The appearance of signs, particularly diarrhea, on the second and third days warrants a bad prognosis. Epilation was followed by death in all except one animal. Comparison with the Japanese with epilation at Hiroshima and Nagasaki demonstrates that a greater percentage of the latter survived than of the goats. It is also pointed out that the course and symptomatology of radiation disease in goats is very similar to that seen in the Japanese, except that the progress of the illness was more rapid than in man.

Therapeutic agents were chiefly transfusions and penicillin.

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